

Trackside Intelligence Pty Ltd

RailBAM® Trending Database v5.8 User Manual

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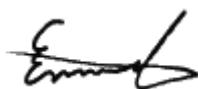
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1. INTRODUCTION

1.1 Overview of the RailBAM® System

Developed by Track IQ™, the RailBAM® System, a Bearing Acoustic Monitoring system is designed to detect and rank axle bearing faults, provide condition monitoring reports and advance warning of potential bearing failure.

The RailBAM® System is located in trackside cabinets (suitable for harsh environments e.g. desert, tropical, cold/wet & snow/freezing) with one installation serving several thousand kilometres (> one thousand miles) of track.

An entire network can be monitored with only a few strategically located RailBAM® systems.

As a train approaches wake-up sensors trigger, and:

- The shutters protecting the acoustical sensors open.
- The data acquisition process begins, including measurement of:
 - Sound signatures emitted by bearings and wheels
 - Train speed and wheel diameter
 - Tag data

Sampled real-time data is analysed by a computerised data acquisition and analysis unit during and immediately after the train has passed the RailBAM® System.

The RailBAM® system extracts bearing fault and wheel flat “signatures” from extraneous noise, enabling fault identification and severity classification. Data for individual bearings is stored in the RailBAM® Trending Database. Further information regarding the RailBAM® System can be found in the RailBAM® System User Manual [RD/1]

1.2 Overview of the RailBAM® Trending Database

Data from trains analysed by RailBAM® is imported into the RailBAM® Trending Database where reports and graphs for bearing and wheel faults can be viewed. Different functions are interlinked through a user-friendly web interface. Features of the database include:

- **Bearing History** plots where bearing deterioration on tagged rolling stock can be monitored over time.
- **Wagon History** form where the histories of all bearings on a wagon are displayed.
- **Train List** form where all selected trains are listed.
- **Train Summaries** showing all faults on a particular train, and relevant information such as train length, vehicle count, train speed, direction of travel and location.
- Most Seen Bearings, First Seen Bearings and Faulty Replaced Bearings forms to aid in prioritising bearings for maintenance.
- Monthly Statistics and Overall Statistics.
- **Parameters** form which enables the current data selection to be changed at any point in the database.
- Records of **removed bearings**, **wagon owners**, bearing types and **orphan** rolling stock (rolling stock for which an owner has not been identified).

- **Security** options to protect rail operators' confidentiality.
- **Remote access** for all authorised users.
- **SQL server** data storage for quick retrieval of data.

Optionally, the Importer/DataChecker can issue various automated messages. This is not an actual function of the web interface; but examples will be shown in this doc. For more details refer to RailBAM® Importer Configuration [RD/2].

Database settings can be configured by users with administrator privileges. Refer to RailBAM® Trending Database Configuration [RD/3] for more details.

2. APPLICABLE AND REFERENCE DOCUMENTS

The following documents form a part of this document to the extent specified herein. In the event of any conflict between this document and any applicable document referenced herein, such conflict shall be reported to the Quality Manager in the Adelaide office of Trackside Intelligence.

All documents shall be used at their most current agreed issue.

2.1 Applicable Documents

Reference to the documents within the text shall be by the following nomenclature, AD/x where "x" denotes the reference document number.

There are no applicable documents.

2.2 Reference Documents

Reference to the documents within the text shall be by the following nomenclature, RD/x where "x" denotes the reference document number.

RD/1	51R-05-5656-UMA-233002	RailBAM® System User Manual
RD/2	51R-05-5656-UMA-239163	RailBAM® Importer Configuration
RD/3	51R-05-5656-TNT-422500	RailBAM® Trending Database Configuration

3. FAULT TYPES AND NOTATION

Each bearing or wheel that passes a RailBAM® system is given a severity classification in the following format:

PREFIX(**TYPE****LEVEL****DESCRIPTOR**)

PREFIX – noise that may interfere with bearing or wheel fault detection, see [Section 3.4].

- **Clpd** – Clipped signal
- **Shrk** – Tonal noise (removed before bearing analysis)
- **FBS** – Flanging, Braking, Slamming
- **NOISY** – Unknown (extraneous) noise

Note: If there is no interfering noise, the prefix will not be present.

TYPE - type of fault [Sections 3.1, 3.2 and 3.3]

- **RS** – Bearing Running Surface fault
- **LF** – Bearing Looseness / Fretting
- **WHLFLT** – Wheel Flat

Note: each pass-by can receive one bearing type (RS or LF) classification and one wheel type (WHLFLT) classification.

LEVEL - severity of the fault

- **1** – Severe fault
- **2** – Moderate fault
- **3** – Minor fault
- **4** – No fault identified

Note: A fourth fault level is used at sites that analyse very quiet rolling stock and level five indicates 'no fault' in these cases. Similarly, wheel flats are identified by two fault levels with level three indicating 'no wheel flat'

DESCRIPTOR - detail about the fault [Section 3.1]

- **_r** – clear roller fault
- **_p** – clear cup fault
- **_n** – clear cone fault
- **_m** – multiple faults
- **_e** – extended fault
- **_s** – extended fault

Note: Descriptor is only applicable to RS type faults.

Examples of severity classification are given below:

- **RS2_r** Clear Running Surface Roller fault of level 2
- **NOISY(LF3)** Looseness / Fretting of level 3 with noise
- **WHLFLT1** Wheel Flat of level 1

The severity classification is used wherever individual pass-by's are displayed, such as the **Bearing History** form detail [Section 4.8.1] and **Train Summary** form detail [Section 4.7].

Individual severity classifications are grouped into categories wherever fault summaries are displayed. This can be seen in the **Train List** form [Section 4.5], **Train Summary** form summary [Section 4.7], **Bearing History** form summary [Section 4.8.1], **Wagon History** form [Section 4.8.3], **Most Seen** form [Section 4.8.6] and **Statistics** plots [Sections 4.8.9 and 4.8.8].

The RailBAM® Trending Database comes with a set of pre-configured severity categories as defined in Table 3-1. Additional severity categories can be created by RailBAM® System administrators. The purpose of severity categories is to assign multiple fault types to one easily recognisable label. This helps manage and display the numerous fault types.

Severity Category	Types	Levels	Descriptors	Prefixes
Clear Level 1	RS	1	_p, _n, _r, _m, _e, _s	Shrk or no prefix
Clear Level 2	RS	2	_p, _n, _r, _m, _e, _s	Shrk or no prefix
Wheel Flats	WHLFLT	1, 2		No prefix
Potential 1&2	RS	1,2		No prefix

Table 3-1: Pre-set severity categories.

Consideration: A severity classification may be included in more than one category. If these categories are displayed in the same fault summary, the total number of faults can include the same fault type more than once.

3.1 Running Surface (RS) Faults

Running surfaces include the cup, cone and rollers of a bearing. Acoustic signatures can be caused by faults such as:

- Spalling. See Figure 3-1 (cup) and Figure 3-2 (cone).
- Brinelling
- Water etching. See Figure 3-3.
- Electrical etching
- Corrosion



Figure 3-1: Cup fault (spalling on raceway) shown with cone removed.



Figure 3-2: Cone fault (spalling on raceway) shown with cage removed.



Figure 3-3: Water etching on rollers. (Spherical Roller Bearings)

A description of particular Running Surface (RS) faults can be determined by the roller pass frequency – the rate at which the rollers move over the cup and cone raceways. When a description of the fault is clearly identifiable, a descriptor is appended to the severity classification. For example, a severe cup fault would be classified as RS1_p.

The approximate roller pass frequencies and descriptors for different RS faults are given in Table 3-2.

Fault Description	Roller Pass Frequency	Descriptor
Cone	12.5 → 14	_n
Cup	10 → 11.5	_p
Roller	3.5 → 4.8	_r
Multiple	Any combination of the above	_m
Extended	Any of the above with additional indication of an extended fault	_e, _s

Table 3-2: Roller Pass Frequencies and Fault Descriptions of specific running surface faults.

3.2 Looseness and Fretting (LF) Faults

Faults that generate a more continuous sound rather than the faster pulsing sound generated by Running Surface (RS) faults are identified by RailBAM® as Looseness and Fretting (LF) faults. The types of faults identified as LF include:

- Looseness
- Fretting
- Seal wear
- Back face wear [Figure 3-4]
- Loss of clamp
- Misalignment



Figure 3-4: Severe back face wear identified as Looseness/Fretting.

Other contributing factors can also be identified as LF faults. These include:

- New seals 'breaking in'
- Equipment rubbing on wheel/axle
- Flanging and Noisy Wheels [Section 3.4]
- Badly tracking bogies
- Wheel flats [Section 3.3]

As these factors are not bearing faults, LF faults are flagged as potential LF related bearing faults. Before removing a bearing identified as an LF fault, the above factors should be checked.

3.3 Wheel Flat (WHLFLT) Faults

Wheel flats produce peaks in the spectrum at one order, since the flat part of the wheel strikes the rail once per wheel rotation. The RailBAM® System distinguishes this from bearing faults, and uses separate ranking thresholds to determine the severity of the wheel flat. An example of a wheel flat is shown in Figure 3-5.



Figure 3-5: Mature wheel flat resulting from a small skid defect.


3.4 Extraneous Noise

Wheels that emit flanging, squealing and other extraneous noises have a potential to produce peaks that may appear like those of RS or LF bearing faults, however it cannot be concluded that these are not true bearing faults. For example, a flanging noise could be obscuring a bearing fault of any kind.

For this reason the severity classifications for such wheels are prefixed with Clpd, Shrkr, FBS or NOISY with the potential fault type and ranking shown in brackets.

- **Clpd** (clipped) indicates noise that causes saturation of the data acquisition equipment
- **Shrkr** (shrieking) indicates a strong tone in a high frequency band. This tone is removed by the RailBAM® System before further analysis, but retained in the sound file.
- **FBS** indicates the presence of Flanging, Braking or Slamming.
- **NOISY** indicates an unknown noise

For example, FBS(RS1) indicates a potential RS1 fault associated with extraneous noise from flanging, braking or slamming.




The **Play Sound**  feature in the **Train Summary** [Section 4.7] and **Bearing History** [Section 4.8.1] forms can be useful in determining the nature of a FBS, NOISY, Clpd or Shrkr pass. It is useful to get a feel for how various fault signatures sound to interpret some RailBAM® trending data comprehensively.

4. DETAILED DATABASE INSTRUCTIONS



4.1 Running the web application

The RailBAM® Trending Database is a rich web application and has been formulated to run across various web browsers.

Recommended web browsers:

BROWSER	OVERALL PERFORMANCE
Google Chrome	 100%
Internet Explorer 7 or 8	 96%
Mozilla Firefox 3 and above.	 80%

The following web browsers can be used but are not recommended due to known issues in the browser:

BROWSER	OVERALL PERFORMANCE	Known Issues
Opera 9	 80%	Windows cannot be dragged.
Internet Explorer 6	 60%	IE6 is an obsolete browser that does not support: <ul style="list-style-type: none"> Modern HTML and CSS standards. Several bugs with rich applications.

Minimum system requirements:

- Windows 2000, XP, VISTA, 7
- 2Ghz CPU

Recommended system requirements:

- Windows 2000, XP, VISTA, 7
- 2.4Ghz CPU or Dual Core 1.2Ghz

Open the RailBAM® Trending Database Web application in your chosen browser by following the URL provided by your I.T. Department (e.g. <https://RailBAM/UITIER/Main.aspx>)

4.2 Log On

After following the provided URL, the **Logon** form is displayed as in Figure 4-1. Each user can be given an individual logon ID and password, allowing access to permitted information only.

The image shows a web-based logon form. It contains two text input fields: the first is labeled 'User name:' and the second is labeled 'Password:'. Below these fields is a checkbox labeled 'Remember me' which is currently checked. To the right of the checkbox is a blue, rounded rectangular button with the text 'Log in' in white.

Figure 4-1: ‘Logon’ form.

Ticking the “Remember me” checkbox checked will cause the login box to remember the user name up to 8 hours so that you only have to enter login details once per day.

4.3 Menu

After the login has been accepted and access is gained into the database, the application menu [Figure 4-2] is displayed. The menu is divided into four sections:

1. Main
2. Statistics
3. Tags & Maint.
4. Window

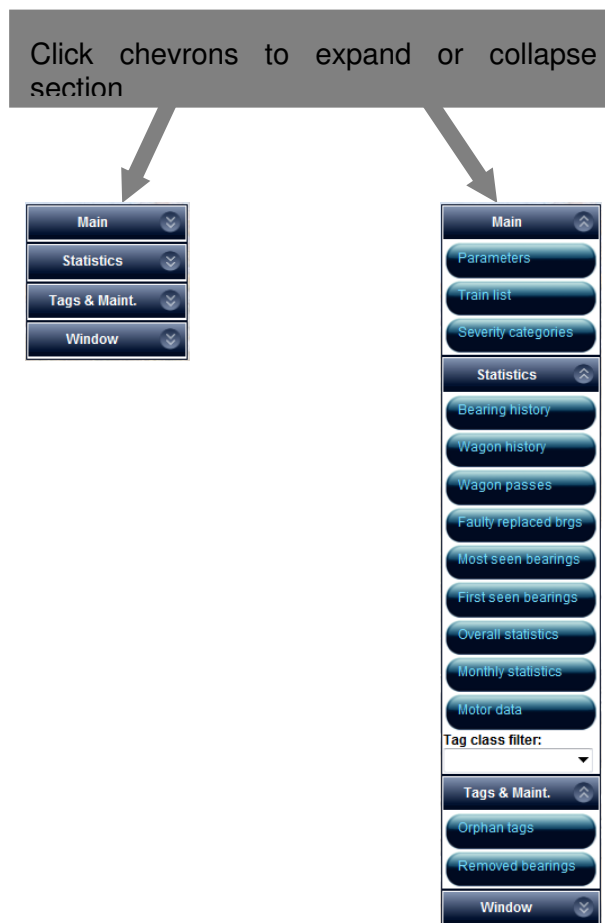


Figure 4-2: 'Main' menu.

Each menu section contains the following functions:

1. Main

- Parameters [Section 4.4]
- Train list [Section 4.5]
- Severity categories [Section 4.6]

2. Statistics

- Bearing history [Section 4.8.1]
- Wagon history [Section 4.8.3]
- Faulty replaced brgs [Section 4.8.5]
- Most seen bearings [Section 4.8.6]
- First seen bearings [Section 4.8.7]
- Overall statistics [Section 4.8.8]
- Monthly statistics [Section 4.8.9]
- Wagon passes [Section 4.8.4]
- Tag Class Filter - A drop down list populated by tag classes. When selected, the tag class acts as a filter over all functions contained in the Statistics section.

3. Tags & Maint.

- Orphan tags [Section 4.9.1]
- User tags [Section 4.9.2]
- Assign tag [Section 4.9.3]
- Removed bearings [Section 4.9.4]

Available to Trend
and Administrator
logins only.

4. Window

- A drop down list of the currently opened windows. Selecting from the drop down list brings the selected window to the front. This is useful when there are many windows opened at the same time.

4.4 Parameters

The **Parameters** form [Figure 4-3] selects the range of information to be displayed across all database functions.

Parameters

Date from: 01/07/2010

Date to: 31/07/2010

Orphans/Untagged: ☒

Removed bearings: ☒

Permitted operators [Select all](#) [Select none](#)

☒ Op1 (Operator-1)

☒ Op2 (Operator-2)

Permitted sites

☒ Site1 (Site-1)

☒ Site2 (Site-2)

January 2008

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

This month Close

March 2008

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

This month Close

Figure 4-3: 'Parameter' form.

- The **Date From** and **Date To** fields limit the date range.
 - Select a date using the calendar "date picker" icon.
- The **Orphans/Untagged** tick box shows or hides orphaned and untagged bearings.
- The **Removed bearings** tick box shows or hides bearings removed from service.
- The **Permitted operators** tick boxes filters the information by wagon operator.
- The **Permitted sites** tick boxes filter the information by RailBAM® site of pass-by.

4.5 Train List

Selecting the **Train list** function from the **Main** section in the application menu displays a list of train passes as shown in Figure 4-4. The train passes are displayed as per the selected criteria in the **Parameters** form.

Each column can be sorted in ascending or descending order. Up to three columns can be sorted at a time. See [section 4.5.1] on sorting data forms.

Time	Site	Train ID	Loco ID	Axles	Vehicles	Length (Metres)	Km/h in	Km/h out	Direction	Fault1 count	Fault2 count	
31/03/2008 02:12:44 PM	Site2		L_1; ABC 008017 R	562	139	2267	64	64	East	8	7	
31/03/2008 04:19:58 AM	Site2		L_1; ABC 007128 L	518	128	2089	63	65	East	11	11	
29/03/2008 07:22:58 PM	Site2			516	128	2084	62	63	East	5	5	
26/03/2008 12:19:00 PM	Site2		L_1; ABC 006699 L	558	138	2250	30	23	East		14	
26/03/2008 09:16:45 AM	Site2		L_1; ABC 007214 L	566	140	2281	65	67	East	6	32	
24/03/2008 10:06:26 PM	Site2		L_1; ABC 005655 L	558	138	2248	65	68	East	7	17	
23/03/2008 04:51:11 PM	Site2		L_1; ABC 007202 L	512	127	2067	54	60	East	2	7	
23/03/2008 01:35:16 PM	Site2		L_1; ABC 007256 L	520	129	2100	63	62	East	14	33	
22/03/2008 02:17:12 AM	Site2		L_2; ABC 006173 L	558	138	2247	76	68	East	12	26	
20/03/2008 05:02:07 AM	Site2		L_1; ABC 006663 R	520	129	2100	18	58	West	2	4	
19/03/2008 12:50:40 PM	Site2			480	119	1935	82	83	East	4	2	
18/03/2008 10:52:27 AM	Site2		L_2; KCS 004020 L	520	129	2099	29	43	East	7	12	
17/03/2008 11:56:26 PM	Site2		L_1; ABC 005886 L	526	130	2120	62	59	West	7	13	
17/03/2008 08:06:11 PM	Site2		L_1; ABC 006663 L	520	129	2097	80	81	East	6	17	
17/03/2008 04:18:14 PM	Site2		L_1; ABC 008103 R	554	137	2235	63	64	East	3	9	
16/03/2008 09:04:05 PM	Site2		L_1; ABC 008252 R	558	138	2249	61	63	East	7	28	
16/03/2008 06:04:17 PM	Site2		L_3; ABC 008135 R	566	140	2286	37	58	East	8	11	
16/03/2008 04:49:43 AM	Site2		L_1; ABC 005796 R	526	130	2123	53	51	West	11	14	
16/03/2008 12:14:01 AM	Site2		L_1; ABC 006610 L	522	129	2104	72	68	East	2	4	
15/03/2008 08:09:18 PM	Site2		L_1; ABC 005878 L	522	129	2106	81	83	East	6	8	
14/03/2008 10:24:44 PM	Site2		L_1; ABC 006444 R	558	138	2248	59	62	East	10	19	
12/03/2008 12:15:35 PM	Site2			520	129	2097	58	60	East	6	16	
12/03/2008 09:56:21 AM	Site2		L_1; ABC 007124 L	558	138	2246	64	67	East	5	14	

Period: 01/Jan/2008 - 31/Mar/2008 | Including Orphans/Untagged | Including Removed Bearings
 Sites: Site1,Site2,Site3 | Operators: Op1,Op2
 Total number of records: 195


Fault1 Fault2 

Figure 4-4: 'Train List' form.

Drop down menus for Fault1 and Fault2 counts. After making a selection hit the refresh button:



Note: These drop downs option do not filter train passes they are used to display a count of specific faults symptoms found in a train.


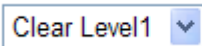
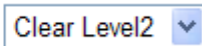


As per parameters form selection, the following is displayed:

- Date range
- Orphans/Untagged
- Removed bearings
- Operators
- Sites

The individual columns on the **Train List** form are:

- **Time:** the time which the train passed the RailBAM® System.
- **Site:** the site as which the train passed the RailBAM® System.
- **Train ID:** on some systems a Train ID is automatically assigned (typically based on a dynamic loco tag containing a Train ID.) Otherwise this is blank.
- **Loco ID:** when the tag of the first locomotive is read, this is displayed in the Loco ID box.
 - If the tag is missing or is not read correctly, the second or third tag will be used.
- **Axles:** indicates the total number of axles analysed on the train.
- **Vehicles:** indicates the total number of vehicles (including locomotives) on the train.
- **Length:** shows the total length of the train.
- **Km/h in/out (MPH in/out):** shows the speed of the train entering (in) and leaving (out) the RailBAM® System.
- **Direction:** shows the direction the train was travelling. Refer to RD/1 for definition of directions.
- **Fault1 Count** and **Fault2 Count** indicate the number of faults on a train that belong to the severity category shown by the drop down options at the bottom of the form. Refer to Chapter 3 for a definition of severity categories.

The **Train List** form possesses the following controls:

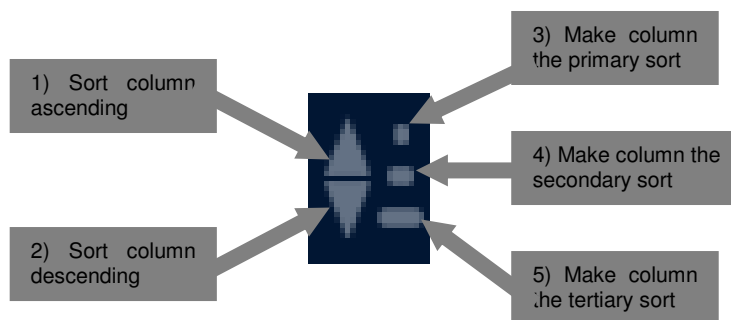
-  Display a summary of that specific train.
- **Fault1**  **Fault2**  Drop down options.
 - Displays a count of specific faults symptoms found in a train.
 - **Note:** Choosing the same type for both categories will double the count when summing the two faults.
-  Refresh data form to populate the Train List as per **Parameters** selected and **Fault1 Count** & **Fault2 Count** options.
-  Export data to Microsoft Excel.

4.5.1 Sorting Data Forms

Data forms consist of columns. Each column heading contains a **sort control**.

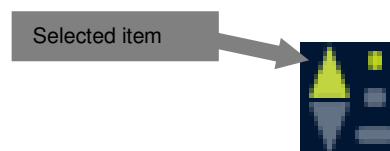


The **sort control** consists of five clickable items:



Click an item to select or unselect it.

Selected Items are highlighted in yellow.



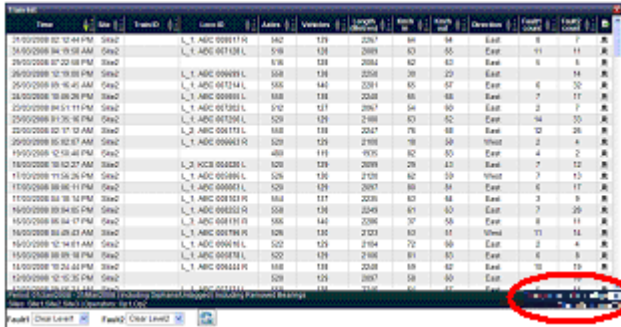
When selecting an item the behaviour of other items on the **sort control** is as follows:

- When selecting ascending or descending, the next available primary, secondary, or tertiary item becomes selected.
- When selecting primary, secondary, or tertiary sort, the ascending item becomes automatically selected.
- When selecting primary and another column is already selected as primary the newly selected column becomes the primary sort and the other column becomes unselected. The same applies for secondary and tertiary.

4.5.2 Data Forms Paging

Paging is used to speed up the rendering of all data forms. Rather than displaying all the data at once, the data is split up into pages of one hundred records.

The paging control is located in the bottom right hand region of data forms



Time	Side	TrainID	LocID	Address	Velocity	Altitude	Height	Weight	Direction	Count	Event
25/05/2008 02:12:44 PM	5862	L_1	ARC 000111 N	142	129	2267	89	58	East	8	7
25/05/2008 04:15:18 AM	5862	L_1	ARC 001131 L	516	138	2089	63	55	East	11	11
25/05/2008 07:20:18 PM	5862			110	138	2082	63	55	East	6	6
25/05/2008 10:18:08 PM	5862	L_1	ARC 000091 L	168	138	2258	39	29	East	14	14
25/05/2008 09:16:40 AM	5862	L_1	ARC 001141 L	168	140	2281	65	57	East	6	22
25/05/2008 10:06:26 PM	3962	L_1	ARC 000091 L	168	138	2258	61	66	East	7	11
25/05/2008 04:51:11 PM	5862	L_1	ARC 001361 L	512	137	2067	64	60	East	2	7
25/05/2008 01:35:16 PM	5862	L_1	ARC 001356 L	529	129	2188	63	62	East	14	10
25/05/2008 02:17:13 AM	3962	L_2	ARC 004111 L	168	138	2247	70	68	East	12	26
25/05/2008 05:10:57 AM	5862	L_1	ARC 000091 N	129	129	2188	18	59	West	2	4
19/05/2008 12:10:40 PM	5862			480	118	1935	62	50	East	4	2
18/05/2008 10:10:27 AM	3962	L_2	KCB 000028 L	129	129	2089	29	43	East	7	12
11/05/2008 11:14:26 PM	5862	L_1	ARC 000091 L	129	136	2129	62	59	West	7	12
11/05/2008 08:06:11 PM	5862	L_1	ARC 000091 L	129	129	2067	60	54	East	6	11
11/05/2008 03:10:14 PM	3962	L_1	ARC 001013 N	168	137	2239	63	68	East	3	9
16/05/2008 09:34:05 PM	5862	L_1	ARC 000031 N	168	136	2245	61	62	East	7	28
16/05/2008 08:54:17 PM	5862	L_1	ARC 001191 N	168	142	2285	37	59	East	8	11
16/05/2008 06:09:03 PM	3962	L_1	ARC 000198 N	129	132	2123	63	61	West	11	14
16/05/2008 12:14:41 AM	5862	L_1	ARC 000111 L	129	129	2104	72	68	East	2	4
16/05/2008 08:16:16 PM	5862	L_1	ARC 000078 L	129	139	2166	61	60	East	4	8
14/05/2008 10:23:44 PM	3962	L_1	ARC 000111 N	168	138	2258	69	62	East	10	19
12/05/2008 12:10:35 PM	5862			129	129	2067	58	60	East		
14/05/2008 05:11:44 PM		L_1	ARC 001111 L	168	139	2216	61	62	East		

Use the previous and next arrows to navigate through the data pages.

Alternatively, select a page number from the drop down menu.

Showing records 1 to 100 | Page 1
Total number of records: 108

In the example above, there is a total of 108 records:

- Page 1 will show records 1 to 100.
- Page 2 will show records 101 to 108.

4.5.3 Data Forms Row Highlighting

This function is available to Mozilla Firefox & Google Chrome users (not Internet Explorer users). Clicking on a data row highlights it in yellow. This is useful for quickly referring to a previously clicked row or cross-referencing information between forms.

Train summary										
Tag	Axle	Side	Train vehicle	Train axle	Severity	Wagon direction	Removed from service	Operator	Wheel Diameter (mm)	
X 021256	4	R	C_3	18	LF3	B-End Leading	No	A	641	
X 021240	1		L_1	1		A-End Leading	No		891	
X 021256	3		C_2	12		A-End Leading	No	A	622	
X 021256	2		C_2	13		A-End Leading	No	A	658	
X 021256	1		C_2	14		A-End Leading	No	A	675	
X 021240	1		C_3	15		B-End Leading	No	A	678	

Note: The highlighter disappears if the form refreshed or closed.

4.6 Severity Categories

The purpose of severity categories is to help manage and display the numerous RailBAM® fault types. The severity categories assign multiple fault types to one easily recognisable label.

The RailBAM® Trending Database comes with a set of pre-configured severity categories, which can be explored as per below.

Click on **Severity categories** in the main menu to reveal the pre-configured severity categories:

Select a category name from the drop down menu to show what each severity is comprised of.

In this screenshot the "Clear Level1" category is comprised of Level 1 Running Surface Faults and includes the items with a check mark next to them, i.e.:

- RS1_p
- RS1_n
- RS1_r
- RS1_m
- RS1_e
- RS1_s

Note: "Potential" stands for a standard RS fault (example RS1) and is not included as it is not considered to be a clear fault.

Select the other categories for the drop down menu and take a look at what they comprise of. To successfully use the RailBAM® Trending Database you should be familiar with each severity category.

Whilst administrators can create new custom categories, RailBAM® Trending Database comes with the following pre-configured severity categories:

- Clear Level 1
- Clear Level 2
- Potential 1&2
- Wheel Flats

See [Section 3] and [Table 3-1] for more detail.



Note that the less specific ('classic') fault rankings that were generated by older RailBAM Wayside software (before ver 5) effectively encompassed the clear and potential rankings.

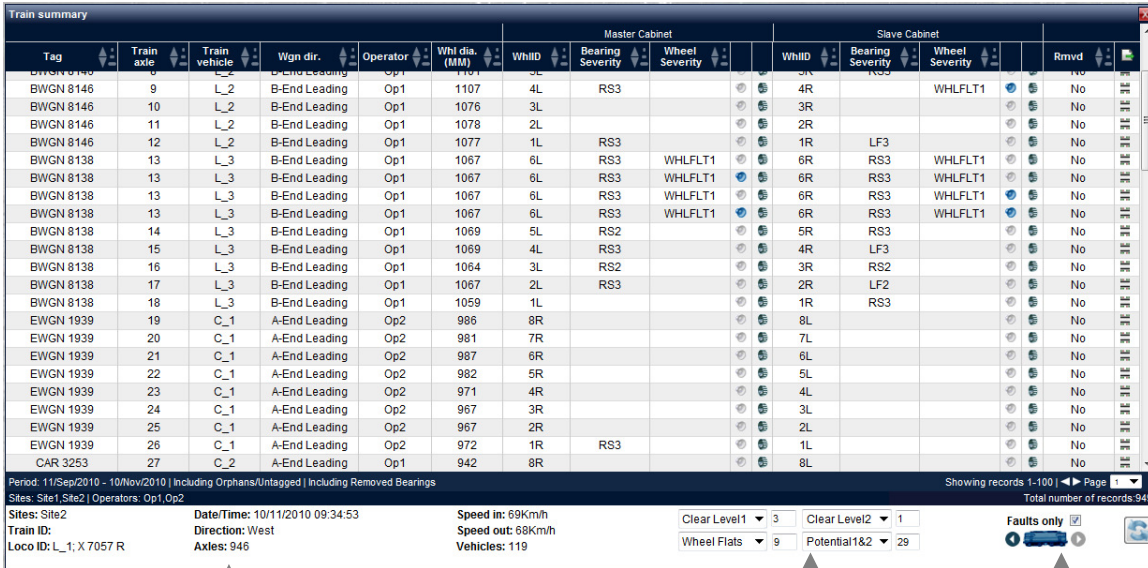
For example, the 'Classic RS1' are now encompassed by RS1 and RS1_e, RS1_m, RS1_r, RS1_n, RS1_p. The corresponding ranking is therefore very similar to RS1*, which is available in the Fault type drop down options.

Alternatively, specific fault categories named, say, 'Classic RS1', 'Classic RS2' and 'Classic RS3' could be created. The definition of 'Classic RS1' would be similar to that of 'Clear Level1' shown above; but with 'potential' ticked and 'ers(_s)' unticked.

4.7 Train Summary

The **Train Summary** can be launched in the following ways:

- Click  on the **Train List** form [Section 4.5]
- Click  on the **Bearing History** form [Section 4.8.1].



The screenshot shows the 'Train summary' form. It features a table with columns for Tag, Train axle, Train vehicle, Wgn dir., Operator, Wbl dia. (MM), WhlID, Bearing Severity, Wheel Severity, WhlID, Bearing Severity, Wheel Severity, and Rmvd. The table lists various train entries with their respective details. Below the table, there is a summary section with fields for Sites, Date/Time, Direction, Axles, Speed in, Speed out, Vehicles, Clear Level1, Clear Level2, Wheel Flats, Potential1&2, and a 'Faults only' checkbox. Arrows point from labels to specific parts of the form: 'General train information' points to the summary fields, 'Fault' points to the 'Faults only' checkbox, and 'Faults only' filter and next/previous train selector points to the navigation buttons.

General train information

Fault

'Faults only' filter and next/previous train selector

Figure 4-5: 'Train Summary' form.

The bottom left of the **Train Summary** form [Figure 4-5] displays the general train information:

- Date/Time:** the time which the train passed the RailBAM® System.
- Site:** the site as which the train passed the RailBAM® System.
- Train ID:** on some systems assignment of a Train ID is done automatically based on a dynamic loco tag containing a Train ID. Otherwise this is blank.
- Loco ID:** when the tag of the first locomotive is read, this is displayed in the Loco ID box. In some cases the first tag may not have been read correctly or the loco may be untagged. In this case the second or third tag will be used.
- No Axles:** indicates the total number of axles analysed on the train.
- No Vehicles:** indicates the total number of vehicles (including locomotives) on the train.
- Direction:** reveals the direction the train was travelling. Refer to RD/1 for definition of directions.
- Speed in/Speed out:** reveals the speed of the train entering (in) and leaving (out) the RailBAM® System.





The individual columns on the **Train Summary** form are:

- **Tag:** The vehicle identification tag.
- **Train axle:** Number of the axle in train. The axle count begins at the first locomotive of the train, unless the system was interrupted, e.g. if the train came to a stop in front of the sensor. In this case the axle count begins from the first axle seen after system start-up.
- **Train vehicle:** Location of vehicle in train. 'C_number' relates to the wagon (car) number starting from the first wagon. Similarly 'L_number' is used for locomotives; 'R_number' is used for road-railer (trailerail) bogies.
- **Severity:** indicates the severity classification of the fault. Refer to Chapter 3 for definition of severity classifications.
- **Wagon dir:** refers to the direction in which the wheel was rotating. A-End Leading means the wagon is travelling forward, B-End Leading means the wagon is travelling backwards. Refer to Appendix B.1.
- **Operator:** displays the wagon operator. Operators of untagged wagons cannot be identified and a blank is displayed in this column. Refer to Appendix B.2.
- **Whl dia. (mm or Inches):** shows the diameter of the wheel measured by the RailBAM® System's wheel sensors.
- **Master Cabinet:** Bearing measures from Master cabinet side. See section below for detail.
- **Slave Cabinet:** Bearing measurements from Slave cabinet side. See section below for detail.
- **Rmvd:** indicates whether the bearings in the axle have been removed from service and identified by the operator as described in Section 4.9.4.

Both **Master Cabinet** and **Slave Cabinet** columns contain the following sub-columns:



- WhlID: wheel/bearing identification (axle number & side such as 1L, or wheel number such as W1)
- Bearing Severity: Bearing severity measurement
- Wheel Severity: Wheel severity measurement

The **Train Summary** form possesses the following controls:

-  Play bearing sound
-  Launch bearing history [Section 4.8.1]
-  Launch wagon history [Section 4.8.3]
- **Faults Only** ☒ Tick or un-tick to hide or show passes with no faults
-  Show previous/next train summary
- | | | | | | |
|--------------|---|----|--------------|---|----|
| Clear Level1 | ▼ | 11 | Clear Level2 | ▼ | 11 |
| Plain RS1 | ▼ | 12 | Wheel Flats | ▼ | 2 |

 - Select from the drop down menu and the fault count automatically updates.

The **Fault counter** displays fault counts for up to four types of fault or fault groups.

- **Note:** Choosing the same type for both categories will double the count when summing the two faults.
-  Refresh data form as per **Parameters** form
-  Export data to Microsoft Excel.

Refer to [Section 3] for a definition of severity categories.

4.8 Statistics

The **Statistics** menu [Figure 4-6]:

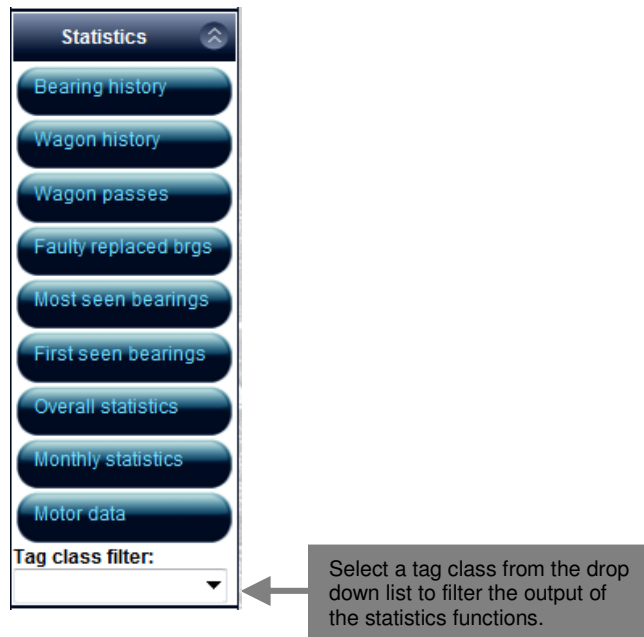


Figure 4-6: 'Statistics' menu.

4.8.1 Bearing History

Bearing history can be accessed through the following routes.

- Train Summary [Section 4.5]
- Statistics menu [Section 4.8]
- Most Seen [Section 4.8.6]
- First Seen [Section 4.8.7]

Bearing histories are only available for tagged wagons. For untagged wagons, because the wagon cannot be identified, only information for one pass-by can be shown. Only data from trains that match the parameters entered in the **Parameters** form [Section 4.4] will be displayed.


Selecting the Bearing History button on the **Statistics** menu will open the Bearing History form.

To display a particular bearing history, enter the Tag, Axle and Side or Wheel depending on the bearing numbering system you are using.

Tag:	<input type="text" value="CAR 4008"/>	Axle:	<input type="text" value="6"/>	Side:	<input type="text" value="R"/>	Wheel:	<input type="text"/>
------	---------------------------------------	-------	--------------------------------	-------	--------------------------------	--------	----------------------

The Tag may be entered in a number of different ways. For example an AAR standard tag, **XXXX 001234x**, may be entered completely (XXXX 001234x) or partially (XXXX1234x, XXXX 1234x, XXXX001234x). The actual format is displayed when tab is pressed. If multiple wagons match the number entered, the desired tag ID can be selected from a list.

If the exact Axle and Side (bearing ID) is not known, the axle and side spaces can be left empty and the information for all bearings on the vehicle are presented.

Click refresh  to display the bearing history information as shown in [Figure 4-7].

Bearing history									
Site	Track side	Train direction	Time	Severity	Tag	Axle	Side	Removed	
Site1	E	North	24/07/2010 20:00:52	RS1_p	CAR 4008	6	R	No	
Site2	W	East	23/07/2010 21:36:24	RS1_p	CAR 4008	6	R	No	
Site2	W	West	23/07/2010 13:29:44	RS2_p	CAR 4008	6	R	No	
Site2	E	East	22/07/2010 13:00:48	RS1_p	CAR 4008	6	R	No	
Site2	E	West	22/07/2010 03:28:01	RS1_p	CAR 4008	6	R	No	
Site2	W	East	20/07/2010 17:15:11	RS1_p	CAR 4008	6	R	No	
Site2	W	West	19/07/2010 21:22:22	RS2_p	CAR 4008	6	R	No	
Site1	E	South	19/07/2010 02:50:20	RS1_p	CAR 4008	6	R	No	
Site1	E	North	18/07/2010 18:33:37	RS1_p	CAR 4008	6	R	No	
Site2	W	East	17/07/2010 17:55:19	Shrk(RS1_p)	CAR 4008	6	R	No	
Site1	W	North	17/07/2010 08:05:16	RS1_p	CAR 4008	6	R	No	
Site1	E	South	16/07/2010 04:14:52	RS1_p	CAR 4008	6	R	No	
Site2	E	West	15/07/2010 19:06:20	RS1_p	CAR 4008	6	R	No	
Site2	E	East	13/07/2010 19:48:49	RS1_p	CAR 4008	6	R	No	
Site1	E	South	4/07/2010 22:41:07	RS1_p	CAR 4008	6	R	No	
Site2	E	West	4/07/2010 09:06:55	RS1_p	CAR 4008	6	R	No	
Site2	W	East	3/07/2010 07:14:41	RS1_m	CAR 4008	6	R	No	
Site1	W	North	2/07/2010 22:42:02	RS1_p	CAR 4008	6	R	No	
Site2	E	East	1/07/2010 17:52:34	RS1_p	CAR 4008	6	R	No	
Site1	E	North	1/07/2010 06:49:48	RS1_p	CAR 4008	6	R	No	

Period: 01/Jul/2010 - 31/Jul/2010 | Including Orphans/Untagged | Including Removed Bearings
 Showing records 1-20 | Page 1
 Sites: Site1,Site2 | Operators: Op1,Op2
 Total number of records:20




Clear Level1: 17 Clear Level2: 2
 Wheel Flats: 0 Potential1&2: 0
 Tag: CAR 4008
 Axle: 6 Side: R Wheel:
 Total number of passes: 20
 Show faults only: ☒ Hide WHLFLT: ☒

Figure 4-7: 'Bearing History' form

The following information is displayed on the **Bearing History** form:

- **Site:** The RailBAM® System site at which the bearing passed.
- **Track Side** shows which side RailBAM® cabinet detected the bearing fault.
- **Train Direction** displays the direction in which the train was travelling when it passed.
- **Time:** The local time at which the train passed the RailBAM® System site.
- **Severity:** The severity classification of the fault for this particular pass-by. Refer to Chapter 3 for a definition of severity classification.
- **Tag:** The tag identification number [Appendix B.1].
- **Axle:** The wagon axle on which the bearing is situated (See Appendix B.1).
- **Side:** The wagon side on which the bearing is located (See Appendix B.1).
- **Axle and Side** combine to give the bearing ID [Appendix B.1].
 - **Note:** To cater for some numbering systems, when side displays a 'W' then the axle column displays the wheel number instead of axle number.
- **Removed:** Indicates if the bearing has been removed from service.

The **Bearing History** form possesses the following controls:

-  Play bearing sound
-  Launch Train Summary [Section 4.7] providing information on the whole train. This is useful for viewing the bearing in relation to other information from nearby wheels.
-  Export data to Microsoft Excel.
- Clear Level1 ▾

17

Clear Level2 ▾

2





Wheel Flats ▾

0

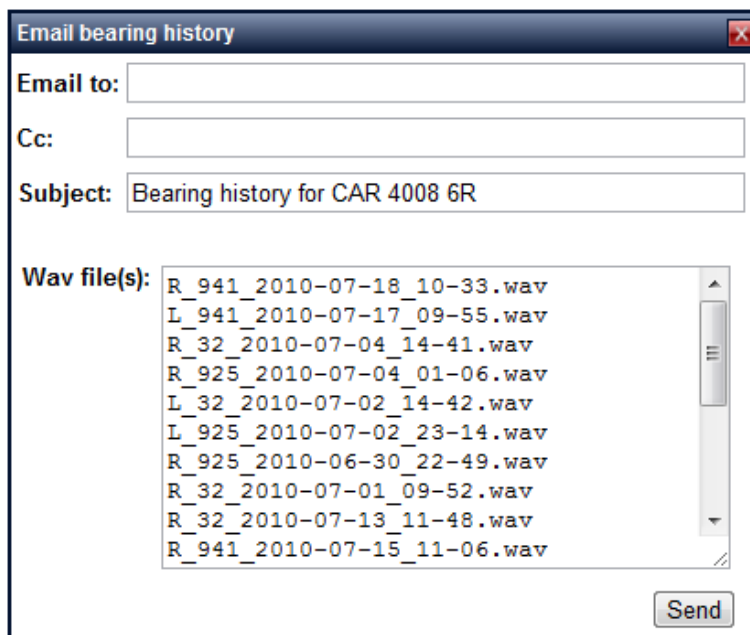
Potential1&2 ▾

0

The Fault counter displays fault counts for up to four types of fault or fault groups.

 - Select from the drop down menu and the fault count automatically updates
 - **Note:** Choosing the same type for both categories will double the count when summing the two faults.
-  Wagon history. A diagrammatic representation of a summarised history of all the bearings in the wagon where the bearing originates.
-  Mark bearing as *pending* removal from service. The bearing is automatically entered into the **bearings remove from service** form [Section 4.9.4] with today's date.
-  Launch the Bearing History graphs - plots of various aspects of the historical bearing measurements.
-  Launch email function to send the bearing history data along with the sound files.

Type in your **Mail to:** address and (optional) **Cc:** address and click **Send**.



Email bearing history

Email to:

Cc:


Subject:

Wav file(s):

- R_941_2010-07-18_10-33.wav
- L_941_2010-07-17_09-55.wav
- R_32_2010-07-04_14-41.wav
- R_925_2010-07-04_01-06.wav
- L_32_2010-07-02_14-42.wav
- L_925_2010-07-02_23-14.wav
- R_925_2010-06-30_22-49.wav
- R_32_2010-07-01_09-52.wav
- R_32_2010-07-13_11-48.wav
- R_941_2010-07-15_11-06.wav

The data is sent as a “RAR” archive containing sound file plus a complete web page comparable to the **Bearing History** form itself.

4.8.2 Bearing History Graph

The **Bearing History graph** is launched from the **Bearing History** form [Section 4.8.1] by clicking .

There are three kinds of charts that can be viewed by selecting the tabs along the top of the form. The tabs are History [Figure 4-8], dB Trends1 [Figure 4-9] and dB Trends2 [Figure 4-10].

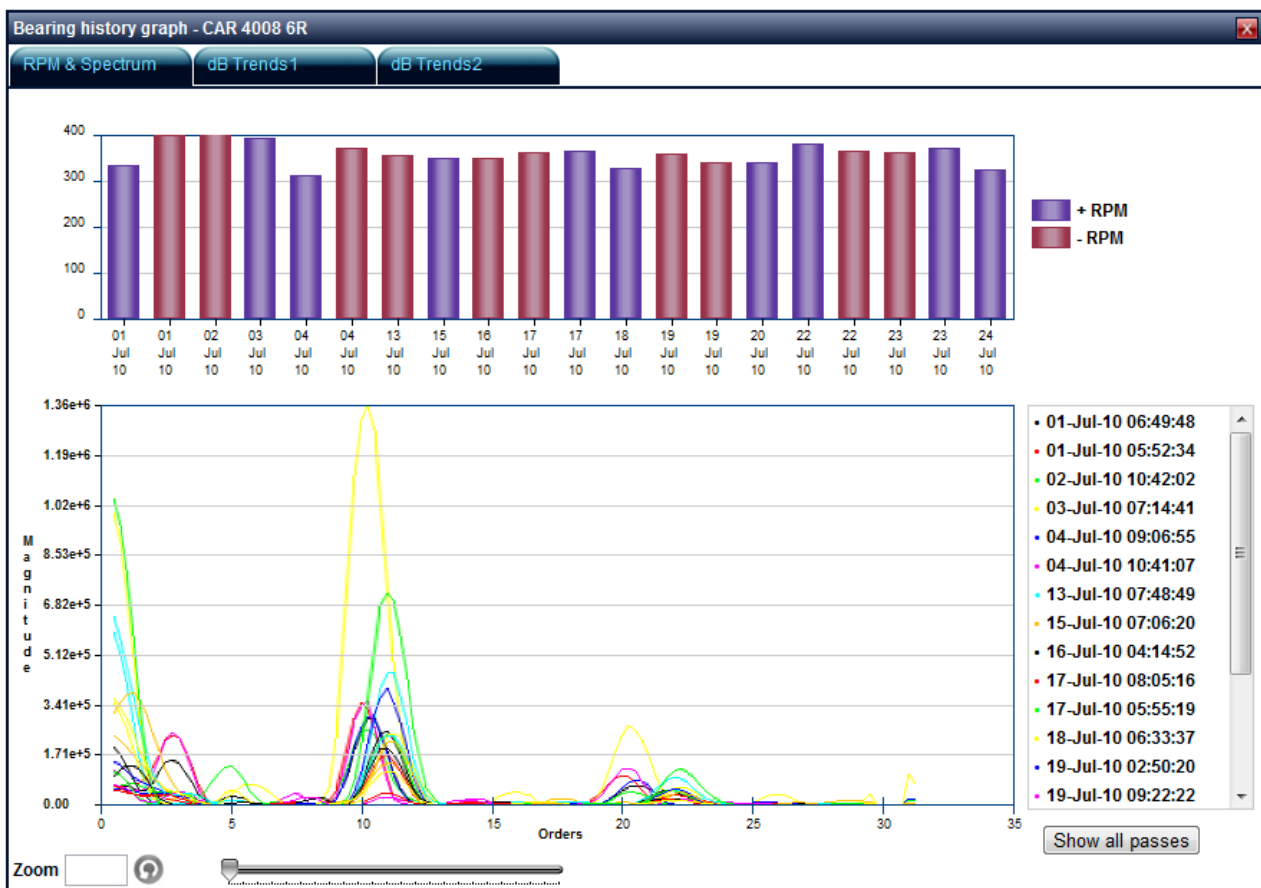


Figure 4-8: 'Bearing History graph' RPM & Spectrum tab.

- The top chart illustrates the **RPM and direction** of the wagon for the bearing(s) being viewed. All readings are based on the location and/or side information of the tag, so train travel direction and wagon orientation are accounted for. See Appendix B.1 for definitions of wagon ends and direction labels.
- The bottom chart illustrates the **fault spectrum** acquired for each pass-by of the bearing. Each pass-by is plotted in a different colour with a legend relating it to that colour at the base of the chart. If a large date selection is chosen the spectra can be cluttered. To overcome this, you have the option to show one pass-by at a time in the fault spectrum chart by clicking on a date time at the left of the bottom chart. To show all passes again click the 'Show all passes' button.

- You can stretch the **fault spectrum** chart in the Y direction entering a Zoom value: e.g. 6.82e5, or by clicking on the magnitude label or by using the slider.

The three graphs on the **dB Trends1** tab [Figure 4-9] show Running Surface (RS) faults by type over the selected time period. RS fault types are described in Section 3.1.

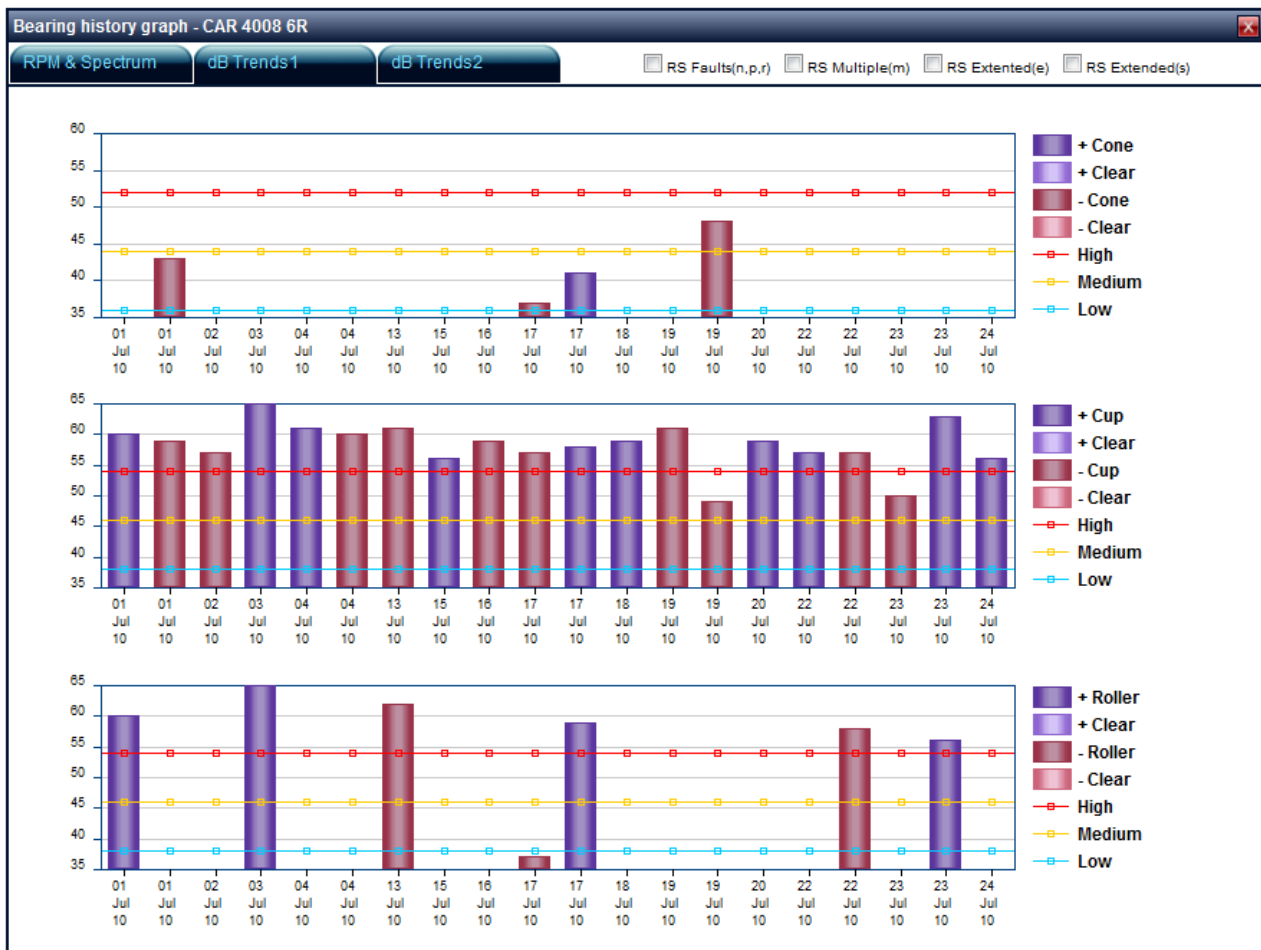


Figure 4-9: 'Bearing History graph' dB Trends1 tab.

- The top chart in dB Trends1 shows Fault Strength of **Cone** faults over time. This particular bearing shows virtually no cone faults, there are only a few Fault Strength bars shown in the chart.
- The middle chart in dB Trends1 shows Fault Strength of **Cup** faults over time. For this example the cup fault has recorded an above High severity level on all days except the second pass on 19-Jul-2010 where a Medium severity level was recorded.
- The bottom chart in dB Trends1 shows Fault Strength of **Roller** faults over time. This particular bearing has spurious roller Fault Strength bar in the representation.
- The values read from the vertical axes are Fault Strength, derived from the Peak Magnitude [Figure 4-8]. The Fault Strength is normalised to a typical running speed of a wheel to enable easy comparisons between bearing passes at different speeds.

The direction of wheel rotation is identified by the colour of the Fault Strength bar presented. The **blue bar** (+) indicates that the wagon was travelling in a positive direction in relation to the tag ("A" end leading), and the **burgundy bar** (-) indicates that the wagon was travelling in the

negative direction (“B” end leading). This helps to determine if the fault is direction dependent [Section 7.5]. The direction of wheel rotation should be taken into consideration when observing the change in Fault Strength over time to determine the amount of bearing deterioration. Further details on using these values to interpret data are included in Chapter 6.2.

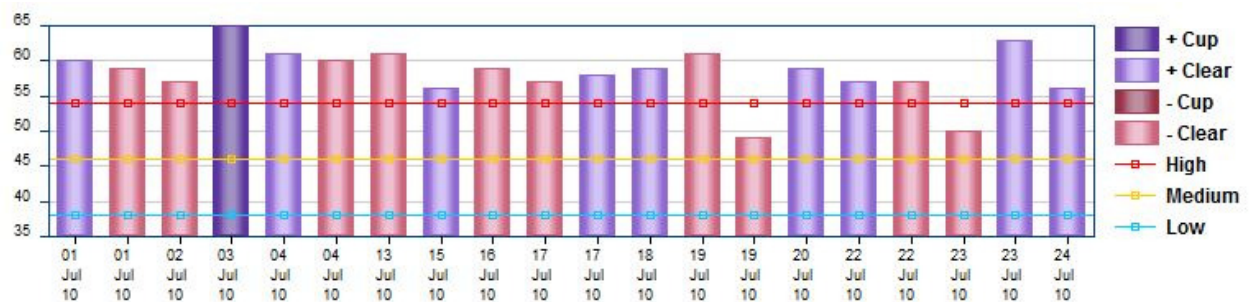
At the top of the form you can use the check boxes to add/remove clear fault types. This is useful to highlight clear faults, and to examine fault trends without a clear fault spectrum.

☐ RS Faults(n,p,r)
 ☐ RS Multiple(m)
 ☐ RS Extended(e)
 ☐ RS Extended(s)

For example, if we tick **RS Faults(n,p,r)**:

☒ RS Faults(n,p,r)

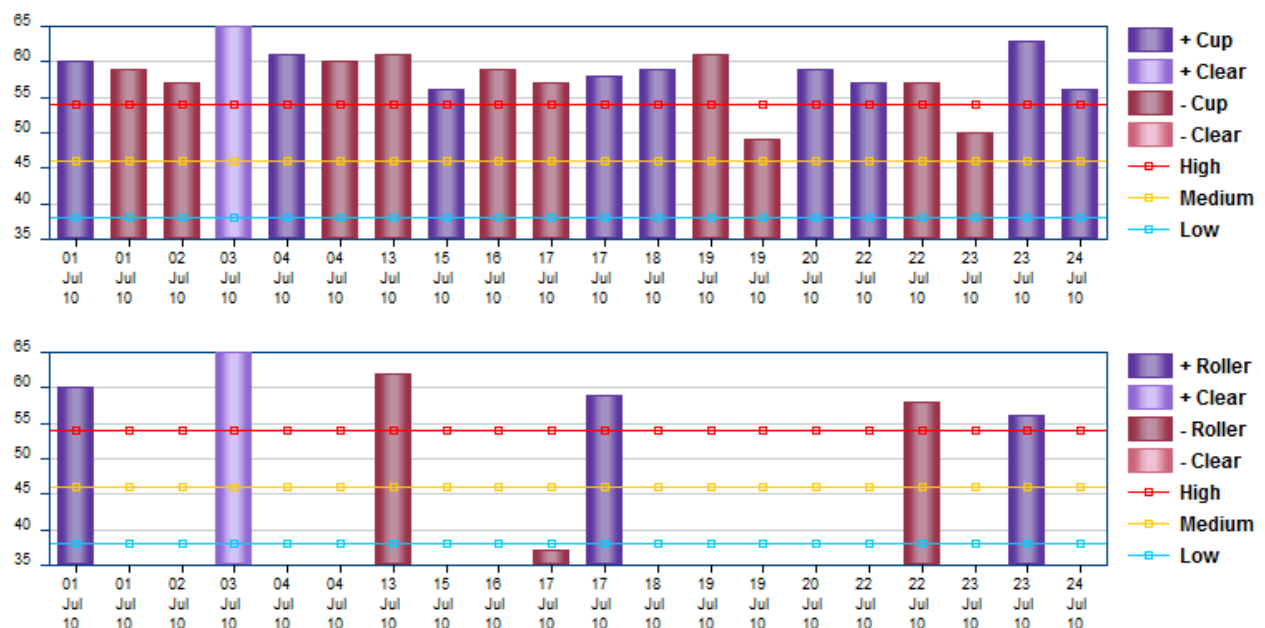
Then the “clear” cup fault passes (RS1_p) are all highlighted except for the multiple fault pass (RS1_m) on 3-Jul-2010:



If we un-tick RS Faults(n,p,r) and tick RS Multiple(m):

☐ RS Faults(n,p,r)
 ☒ RS Multiple(m)

Then multiple fault pass (RS1_m) on 3-Jul-2010 is highlighted:



The **dB Trends2** tab uses the same format as **dB Trends1** to show all remaining potential bearing faults (those which are not RS faults).

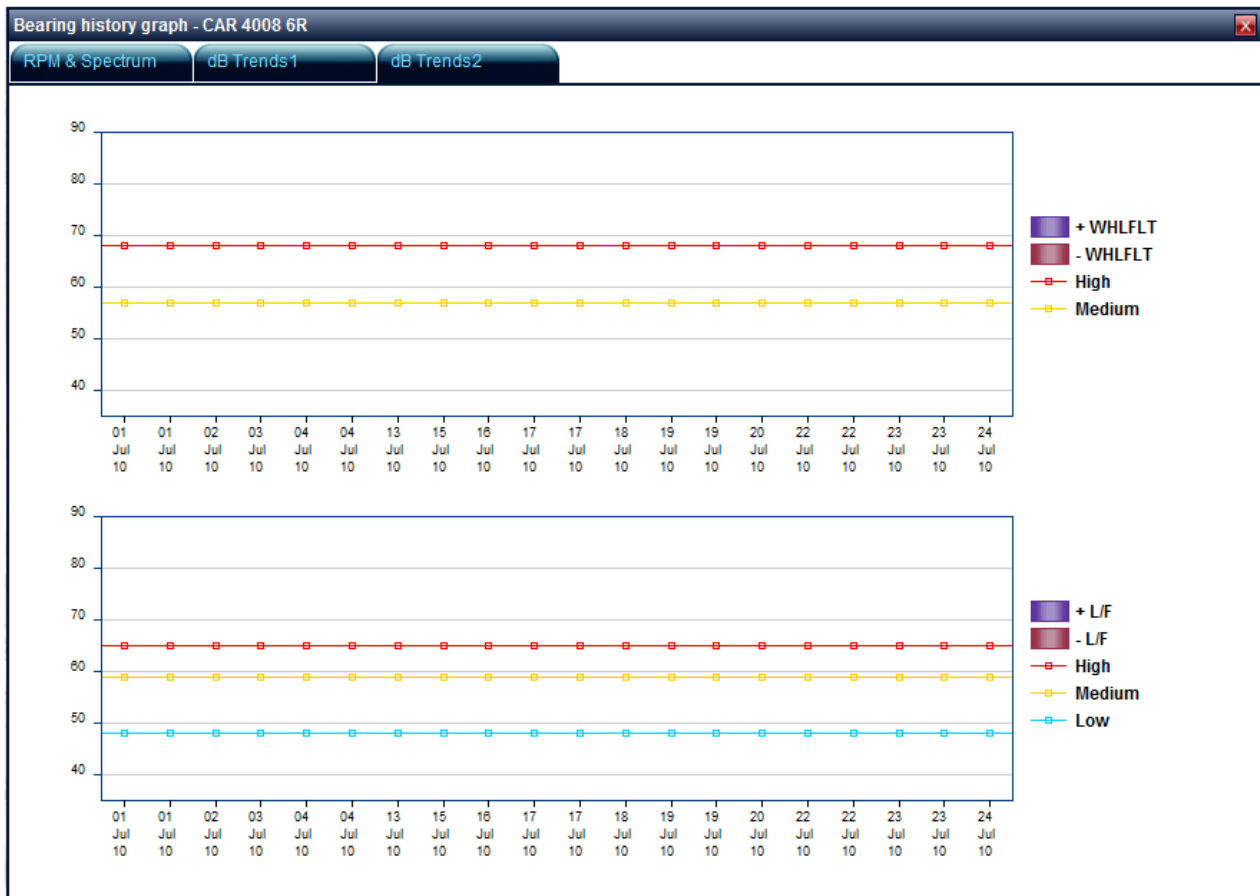


Figure 4-10: 'Bearing History graph' dB Trends2 tab.

- The top chart in **dB Trends2** shows the Fault Strength of potential **Wheel Flats (WHLFLT)**. In this example there are no wheel flats are recorded for this wheel.
- The bottom chart in **dB Trends2** shows the Fault Strength of potential **Looseness / Fretting (LF)** faults. In this example there is no looseness fretting detected. Section 3.2 explains faults signatures related to rubbing on the wheel or axle.

4.8.3 Wagon History

The **Wagon History** form [Figure 4-11] displays summaries of fault readings for each bearing on a vehicle. Only bearings passes that match the parameters entered in the **Parameter** form are included in the lists. Bearings with faults identified in the selected severity categories are displayed in **red** and bearings without are displayed in **green**. The fault lists display a fault count for each severity category. The most severe fault is at the top of each list.


The screenshot shows the 'Wagon History' window. In the center is a horizontal model of a wagon labeled 'CAR 000531'. Above and below the wagon are eight bearing locations, each with a 'Fault' and 'Cnt' (count) table. The bearings are labeled 1L, 2L, 3L, 4L, 1R, 2R, 3R, and 4R. The 4L and 4R bearings are highlighted in red, while the others are green. A callout box points to the 4L bearing with the text: 'Click a bearing to show its individual history.'

Bearing	Fault	Cnt
1L		
2L		
3L		
4L	Clear Level1	1
4L	Plain RS1	1
1R		
2R		
3R		
4R	Clear Level1	6
4R	Plain RS1	6



At the bottom of the window, there are controls for filtering and navigation. On the left, there are dropdown menus for 'Clear Level1' (set to 7), 'Clear Level2' (set to 0), 'Plain RS1' (set to 7), and 'Wheel Flats' (set to 0). In the center, the 'Tag' is set to 'CAR 000531'. On the right, the 'Total number of passes' is 6. Below these, there are buttons for 'CAR 000530', 'CAR 000531', and 'CAR 000532', with 'CAR 000531' being the active selection. There are also icons for refreshing data and navigating between wagons.

Figure 4-11: 'Wagon History' form.


The **Wagon History** form possesses the following controls:

- Click  to add ticked bearings/wheelsets as pending removal from service. The bearings/wheelsets are automatically entered into the **bearings remove from service** form [Section 4.9.4] with the current date.
- | | | | | | |
|--------------|---|----|--------------|---|----|
| Clear Level1 | ▼ | 11 | Clear Level2 | ▼ | 11 |
| Plain RS1 | ▼ | 12 | Wheel Flats | ▼ | 2 |

The Fault counter displays fault counts for up to four types of fault or fault groups.

 - Select from the drop down menu and the fault count automatically updates
 - Note:** Choosing the same type for both categories will double the count when summing the two faults.
-  Refresh data form as per **Parameters** form and fault counter selection.
-  Display previous/next non-orphan wagon (In Alphabetical tag order)

- Selecting the **Wagon History** on the **Statistics** menu will open the Wagon History form.

To display a particular bearing history, enter a **Tag:** then click 

4.8.4 Wagon passes

Depending on the location of RailBAM® cabinets and the routing of the traffic, not all rolling stock may be scanned by the RailBAM® systems. The wagon passes form lists all known rolling stock and the number of times each side of the wagon has been seen by the RailBAM® system.

Based on this report, decisions can then be made to reroute traffic to expose rolling stock to the RailBAM® system.

In Figure 4-12, the form reports that some vehicles have been seen 72 times or more for the period selected in Global Parameter Selection whilst other have been seen 3 times and some not at all.

Wagon passes		
Tag	Passes L (AAR)	Passes R (AAR)
BWGN 7055	80	80
CAR 1503	72	72
CAR 1525	72	72
CAR 1526	72	72
CAR 1539	72	72
CAR 3432	3	3
EWGN 1910	3	3
ACAR 56		
CAR 1815		
CAR 2435		
CAR 2547		

Period: 11/Sep/2010 - 10/Nov/2010 | Excluding Orphans/Untagged | Including Removed Bearings
 Sites: Site1,Site2 | Operators: Op 1,Op2
 Showing records 1-100 | Page 1
 Total number of records:9724

 ☐ Ignore tag class

Figure 4-12: Wagon passes

In the case of sites with single RailBAM cabinets as opposed to sites with dual RailBAM cabinets, Passes L & Passes R may not always be equal. This is because only one side of the vehicle will be measured by the RailBAM system in this configuration. Should one side of a vehicle not be exposed enough then decisions can be made to re-orient vehicles within the train consist to enable exposure.



Refreshes data form as per **Parameters** form. **Note:** Upon opening the form, refresh must be pressed in order to see the data.

The “Ignore tag class” check-box is to cater for a specific case of vehicle tagging convention. In the event that all coupled vehicles share the same vehicle number, this tick box enables counting of the coupled vehicles as if they were one.

4.8.5 Faulty Replaced Bearings

Selecting **Faulty Replaced Brgs** from the **Statistics** menu displays tagged bearings that have developed fault symptoms soon after being replaced (Figure 4-13). Only wagons that match the parameters entered in the **Parameters** form are included.

Removal Date	Tag	Axle	Side	Operator	Fault Count
01 Feb 2008	CAR 099674	3	R	Op1	8
01 Feb 2008	CAR 098516	2	R	Op1	7

Period: 01/Feb/2008 - 29/Feb/2008 | Including Orphans/Untagged | Including Removed Bearings
 Sites: Site1,Site2,Site3 | Operators: Op1,Op2
 Total number of records:2

Fault: Clear Level1 Min: 5

Show removed bearings faulty within 10 day(s) or 5 pass(es) after removal


Figure 4-13: ‘Faulty Replaced Bearings’ form.

The following information is displayed on the **Faulty Replaced Bearings** form:

- **Removal Date:** The date the bearing had been removed from service
- **Tag:** The tag identification number [Appendix B.1]
- **Axle** and **Side** combine to give the bearing ID [Appendix B.1]
- **Operator** displays the wagon operator.

- **Fault count** indicates the number of times the bearing was seen with a fault belonging to the severity category shown by the fault drop down option. Refer to Chapter 3 for a definition of severity categories.

The **Faulty Replaced Bearings** form possesses the following controls:

- **Fault:** The type and number of fault criteria.
- **Show removed bearings faulty within** **day(s) or** **pass(es) after removal** , The number of days or passes after removal criteria.
-  Refresh data form as per **Parameters** form and fault criteria selection.

4.8.6 Most Seen Bearings

Selecting **Most Seen Bearings** from the **Statistics** menu displays a list of bearings that have been detected with the highest number of fault symptoms for a chosen fault type (Fault1). Only wagons that match the parameters entered in the **Parameters** form and that match Fault1 type are included. Fault2 provides a secondary fault count but does not determine the form results.

Tag	Axle	Side	Operator	Fault1 Count	Consistency 1	Fault2 Count	Consistency 2	Passes		
WGN 10449	4	R	Op1	23	70%	0	0%	33		
CAR 3432	2	R	Op1	21	78%	2	7%	27		
CAR 1577	3	R	Op1	20	52%	0	0%	32		
CAR 3047	1	L	Op1	18	66%	5	18%	25		
CAR 3763	5	R	Op1	18	55%	3	9%	33		
CAR 2745	8	L	Op1	18	69%	2	8%	24		
CAR 2494	6	R	Op1	18	67%	1	4%	25		
EWGN 2138	8	R	Op2	17	55%	3	10%	31		
CAR 4008	6	R	Op1	17	85%	2	10%	20		
WGN 10259	6	R	Op1	16	57%	0	0%	28		
CAR 2023	4	L	Op1	15	52%	2	7%	25		
CAR 1555	3	L	Op1	14	38%	2	5%	26		
CAR 3111	3	R	Op1	13	43%	6	20%	30		
CAR 4008	6	L	Op1	13	62%	2	10%	20		
CAR 1550	5	R	Op1	13	28%	2	4%	32		
EWGN 1700	1	R	Op2	13	62%	1	5%	21		
CAR 2617	4	L	Op1	13	54%	1	4%	22		
WGN 10407	5	L	Op1	12	36%	3	9%	32		
CAR 3545	8	L	Op1	12	41%	1	3%	27		
CAR 2537	7	R	Op1	12	53%	0	0%	21		
CAR 2035	7	L	Op1	12	45%	0	0%	23		
CAR 3950	6	L	Op1	12	48%	0	0%	24		
CAR 3840	3	R	Op1	11	39%	7	25%	28		
CAR 3058	8	R	Op1	11	58%	1	5%	19		
CAR 3612	3	R	Op1	11	46%	1	4%	24		

Period: 01/Jul/2010 - 31/Jul/2010 | Including Orphans/Untagged | Including Removed Bearings
 Sites: Site1,Site2 | Operators: Op1,Op2
 Showing records 1 to 51 | Page 1
 Total number of records:51
 Max axles:50 Fault1: Clear Level1 Fault2: Clear Level2 Passes >= 0 Consistency1 >= 0 Consistency2 >= 0



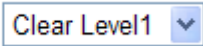
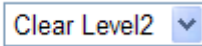
Figure 4-14: 'Most Seen Bearings' form.

The following information is displayed on the **Most Seen Bearings** form:

- **Tag ID:** The tag identification number [Appendix B.1].
- **Axle** and **Side** combine to give the bearing ID [Appendix B.1].

- **Operator** displays the wagon operator.
- **Fault 1 & 2 count** indicates the number of times the bearing was seen with a fault belonging to the severity category shown by the fault drop down options. Refer to Chapter 3 for a definition of severity categories.
- **Consistency 1 & 2** is the percentage value of how consistent the fault readings have been each time the bearing has been measured by the RailBAM® System. If a fault level is maintained or increases steadily over time then the consistency percentage value will be high. If readings are more sporadic then the consistency percentage value will be low.
- **Passes** displays the total number of times the bearing has passed a RailBAM® System during the period in the **Parameters** form.




The **Most Seen Bearings** form possesses the following controls:

-  Launch bearing history [Section 4.8.1].
-  Mark bearing as pending removal from service. The bearing is automatically entered into the **bearings remove from service** form [Section 4.9.4] with today's date.
- You can choose which fault type or group will be used to generate the data using the fault 1&2 drop down menus **Fault1**  **Fault2** 
 - **Note:** Choosing the same type for both categories will double the count when summing the two faults.
- You can specify the maximum number of axles to be included. The axles with the most fault counts will be included.

Max axles

- You can filter the set of vehicles show in this list by Passes and Consistency1&2 filter controls:

Passes >= Consistency1 >= Consistency2 >=

- Click  to activate filter.
 - Entering a value in Passes will filter out any result with less passes than the value entered.
 - Entering a value in Consistency1 will filter out any result with less Consistency than the value entered.
 - Entering a value in Consistency2 will filter out any result with less Consistency1 than the value entered.
-  Refresh data form as per **Parameters** form and **Fault1 Count & Fault2 Count** options. **Note:** Upon opening the form, refresh must be pressed in order to see the data.
-  Export data to Microsoft Excel.

4.8.7 First Seen Bearings

Selecting **First Seen Bearings** from the **Statistics** menu displays the first reading of each bearing fault at a severity in the selected category. Only bearings that match the parameters entered in the **Parameters** form are included.




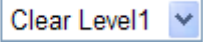


First seen bearings						
Tag	Axle	Side	Severity	Operator	Time	
WGN 002888	4	L	RS1_e	Op2	31/03/2008 2:12:44 PM	
WGN 003014	1	L	RS1_n	Op2	31/03/2008 2:12:44 PM	
CAR 098586	2	R	RS1_e	Op1	31/03/2008 4:19:58 AM	
CAR 098558	3	R	RS1_e	Op1	31/03/2008 4:19:58 AM	
CAR 098586	4	L	RS1_m	Op1	31/03/2008 4:19:58 AM	
PSG 043093	2	L	RS1_n	Op2	30/03/2008 7:11:48 AM	
CAR 006740	4	L	RS1_n	Op1	29/03/2008 7:22:58 PM	
CAR 000584	4	L	RS1_e	Op1	29/03/2008 7:22:58 PM	
PSG 022760	3	L	RS1_n	Op2	26/03/2008 10:29:34 AM	
WGN 002348	3	R	RS1_e	Op2	26/03/2008 9:16:45 AM	
WGN 003738	4	R	RS1_e	Op2	26/03/2008 9:16:45 AM	
PSG 027820	2	L	RS1_e	Op2	25/03/2008 3:12:52 PM	
WGN 003281	3	L	RS1_e	Op2	24/03/2008 10:06:26 PM	
WGN 002189	3	L	RS1_n	Op2	24/03/2008 10:06:26 PM	
PSG 221110	1	R	RS1_e	Op2	24/03/2008 4:26:52 AM	
CAR 098563	2	R	RS1_n	Op1	23/03/2008 1:35:16 PM	
CAR 002533	1	L	RS1_e	Op1	23/03/2008 1:35:16 PM	
WGN 003261	2	L	RS1_e	Op2	22/03/2008 2:17:12 AM	
WGN 003491	4	R	RS1_e	Op2	22/03/2008 2:17:12 AM	
WGN 003795	1	L	RS1_m	Op2	22/03/2008 2:17:12 AM	
WGN 003053	3	L	RS1_m	Op2	22/03/2008 2:17:12 AM	
WGN 002407	4	R	RS1_e	Op2	22/03/2008 2:17:12 AM	
WGN 002462	1	L	RS1_e	Op2	22/03/2008 2:17:12 AM	
WGN 002116	3	L	Shrk(RS1_e)	Op2	22/03/2008 2:17:12 AM	
WGN 002122	4	R	RS1_e	Op2	22/03/2008 2:17:12 AM	
Period: 01/Jan/2008 - 31/Mar/2008 Including Orphans/Untagged Including Removed Bearings						
Sites: Site1,Site2,Site3 Operators: Op1,Op2						
Total number of records:619						
Fault <input type="text" value="Clear Level1"/> 						

Figure 4-15: First Seen form.

The following information is displayed on the **First Seen Bearings** form:

- **Tag** is the tag identification number [Appendix B.1]
- **Axle**: The wagon axle on which the bearing is situated (See Appendix B.1.)
- **Side**: The wagon side on which the bearing is located (See Appendix B.1.)
- **Severity** indicates the severity classification assigned to the first pass-by of the faulty bearing. Refer to Chapter 3 for a definition of severity categories.
- **Operator** displays the wagon operator.
- **Time** of the first reading at this severity for this bearing.

The **First Seen Bearings** form possesses the following controls:

-  Launch bearing history [Section 4.8.1]
-  Mark bearing as pending removal from service. The bearing is automatically entered into the **bearings remove from service** form [Section 4.9.4] with today's date.
- You can choose which fault type or group will be used to generate the data using the fault drop down menu **Fault1** 
-  Refresh data form as per **Parameters** form and **Fault1 Count** & **Fault2 Count** options.
-  Export data to Microsoft Excel.

4.8.8 Overall Statistics

The **Overall Statistics** buttons on the **Statistics** menu [Figure 4-2] displays the overall statistics graphs [Figure 4-16 and Figure 4-17] by severity category. Only information that matches the parameters entered in the **Parameters** form is plotted.

There are two variations of the Overall Statistics graph selectable by tabs.

(By passes):

In this variation of the graph, each bearing pass measured by RailBAM is considered. The fault percentage is calculated as the number of faulty bearing measurements at a selected severity divided by the total number of bearing measurements in the system.

Selected bearings will include Orphan and Untagged wagons if that checkbox is ticked in the **Parameters** form.

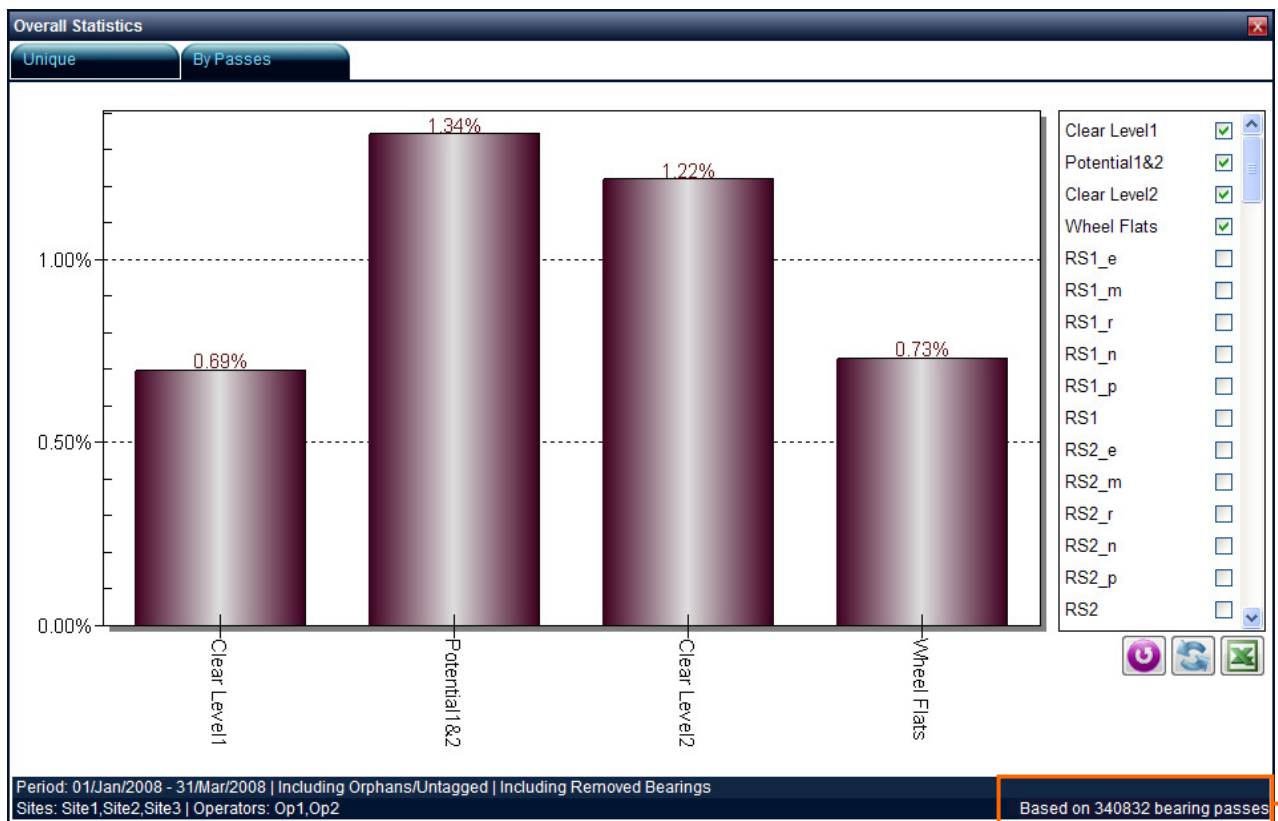


Figure 4-16: 'Overall Statistics (By passes)' graph

The total number of bearings that have passed the selected sites is displayed at the bottom right hand corner of the form.

(Unique):

In this variation of the graph, each individual bearing is only counted once, i.e. is unique regardless of the number of passes. The percentage is calculated as the number of faulty bearings at a selected severity divided by the total number of bearings in the system.

As this report is based on individual tags, untagged wagons cannot be included in the graph. Orphans can be included depending on **Parameters** form selection.

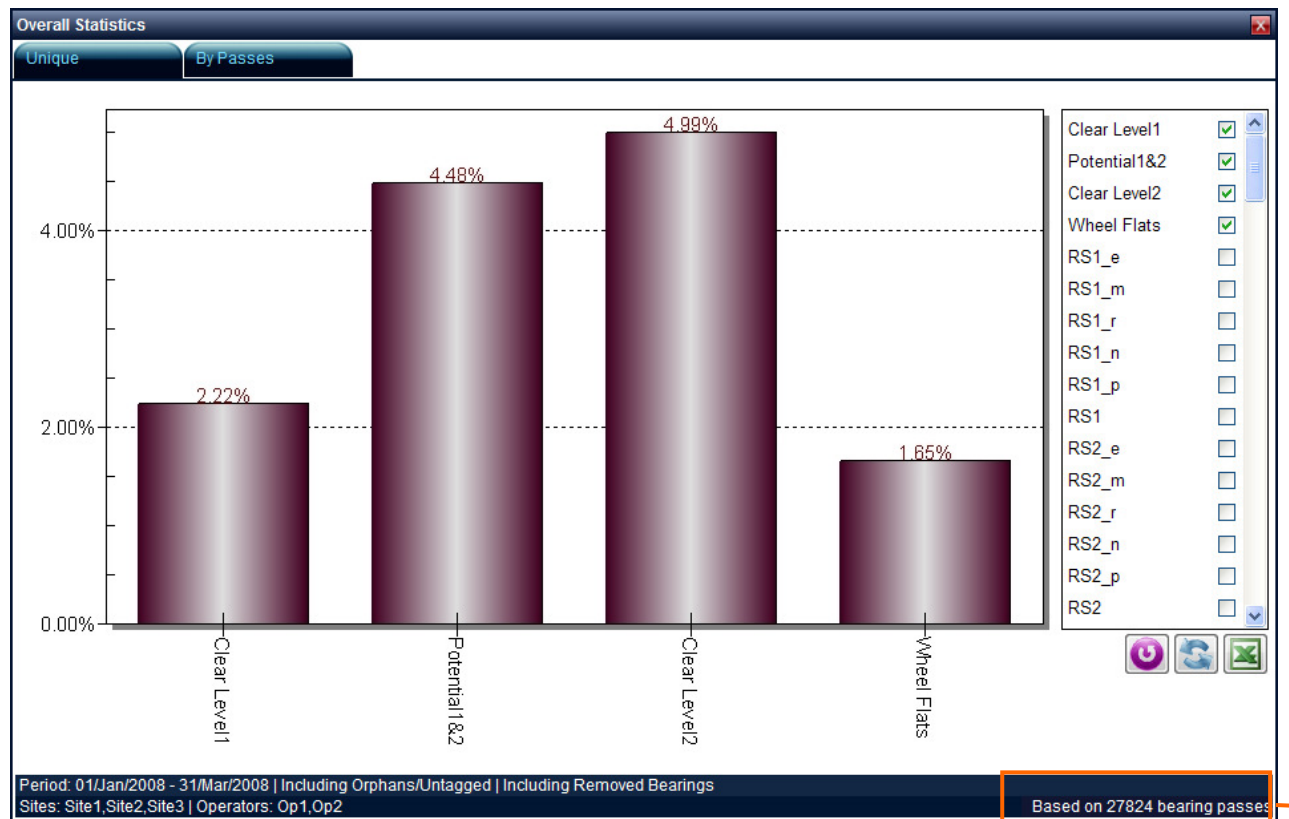
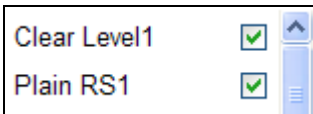





Figure 4-17: 'Overall Statistics (Unique)' graph

The total number of unique bearings that have passed the selected sites is displayed at the bottom right hand corner of the form.

The **Overall Statistics** form possesses the following controls:

- Fault Selector:  Tick the faults types to include in the graph
-  Refresh data form as per **Parameters** form and fault types selected
-  Restore fault types to default selection and Refresh data form as per **Parameters** form
-  The percentage data can be exported to Excel to form the data set for an Excel graph.

4.8.9 Monthly Statistics

The **Monthly Statistics** buttons on the **Statistics** [Figure 4-6] displays the monthly statistics graphs [Figure 4-18 and Figure 4-19] by severity category.

There are two variations of the Overall Statistics graph:

(By passes):

In this variation of the graph each bearing measurement seen by the system is considered.

The graph shows a monthly breakdown of the percentage of bearing measurements at a selected severity divided by the total number of bearing measurements in that month.

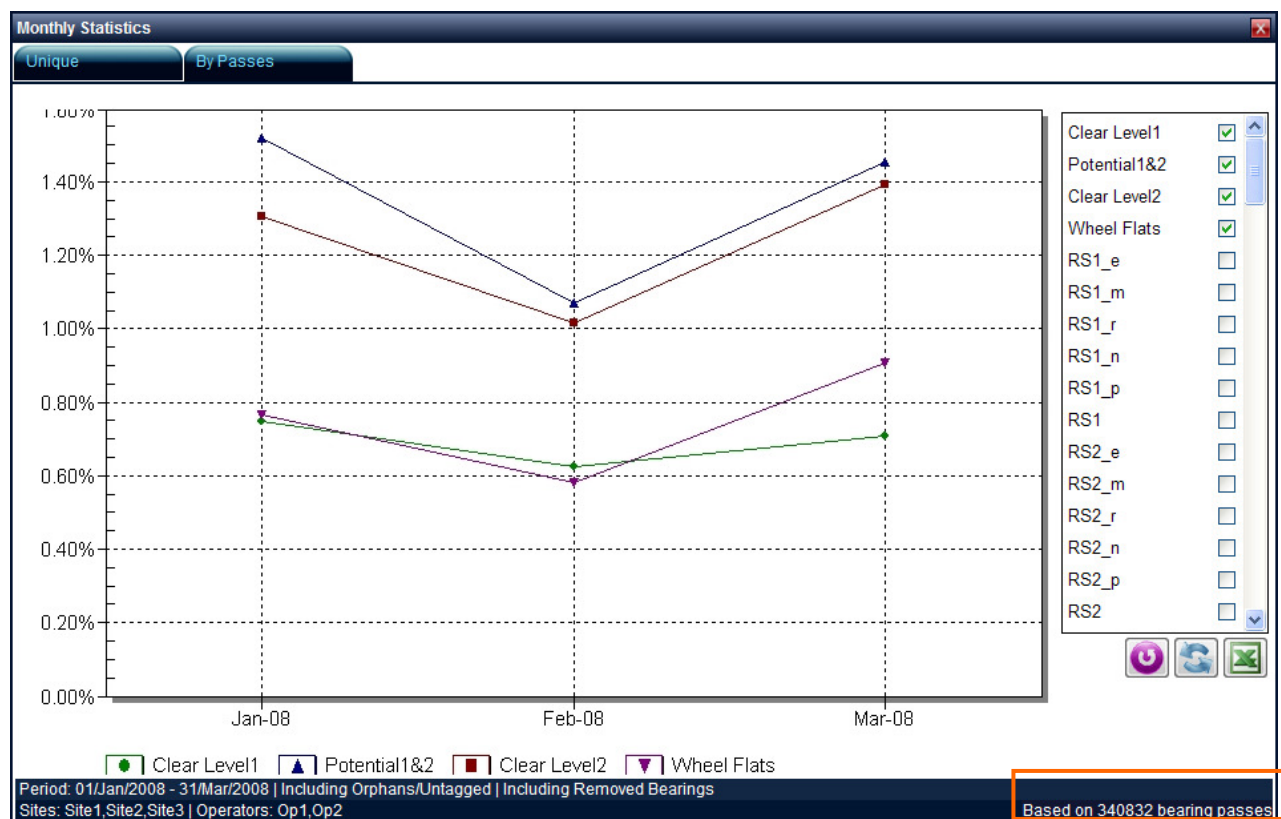


Figure 4-18: 'Monthly Statistics (By passes)' graph

The total number of bearings that passed the selected sites is displayed at the bottom right hand corner of the form.

The total number of bearing passes for each individual month is not displayed, but is factored into the calculation.

(Unique):

In this variation of the graph, each individual bearing is only counted once, i.e. is unique regardless of the number of passes.

The graph shows a monthly breakdown of the percentage of faulty bearings divided by the total number of bearings.

As this report is based on individual tags, untagged wagons cannot be included. Orphans can be included depending on **Parameters** form selection.

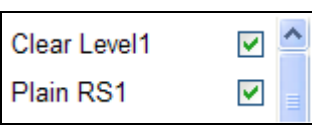





Figure 4-19: 'Monthly Statistics (Unique)' graph

The total number of total number of bearing that passed the selected sites is displayed at the bottom right hand corner of the form.

The total number of bearing passes for each individual month is not displayed, but is factored into the calculation.

The **Monthly Statistics** form possesses the following controls:

- Fault Selector:  Tick the faults types to include in the graph
-  Refresh data form as per **Parameters** form and fault types selected
-  Restore fault types to default selection and Refresh data form as per **Parameters** form
-  The percentage data can be exported to Excel to form the data set for an Excel graph.

4.9 Tags and Maintenance

The **Tags and Maint.** menu [Figure 4-20] offers the following functions:

- Orphan tags
- User Tags
- Assign Tags
- Removed bearings



Figure 4-20: 'Tags and Maintenance' menu.

The Tags and Removed Bearings functions are used by RailBAM® System administrators to assign tag ownership and by rolling stock maintainers for entering removed bearings.

4.9.1 Orphan Tags

The **Orphan Tags** form [Figure 4-21] displays a list of tags that have been read by a RailBAM® System, but are not listed in the **Permitted User's Tags** list [Section 4.9.2]. This may be due to the tag being misread, or not yet assigned to the list of operators' wagons. It is the responsibility of the RailBAM® System administrator to resolve orphan tags by assigning tags from this list to rolling stock operators, as described in [Section 4.9.3].



Figure 4-21: 'Orphan Tags' form

You can export the data to Microsoft Excel by clicking .

4.9.2 User Tags

The **User's Tags** form [Figure 4-22] displays a list of the wagons with identification tags held in the RailBAM® Trending Database, and the associated wagon operator and bearing type (optional). It is the responsibility of the RailBAM® System administrator to update this table according to information provided by rolling stock operators.

Tag	Operator ID	Bearing Type
AEPX 003337	1	
AEPX 003342	1	
AEPX 003385	1	
CAR 000501	1	
CAR 000502	1	
CAR 000503	1	
CAR 000504	1	
CAR 000505	1	

Total number of records: 3482

Tag:

Operator:

Brg Type:

Add Delete

Figure 4-22: 'User Tags' form


To add a new user tag:

1. Type in a new tag into the **Tag** box
2. Select an **Operator** from the drop down menu
3. Select a **bearing type** from the drop down menu (optional)
4. Click **Add**

To delete a tag or a set of tags:


1. Type in a tag into the **Tag** box (or a wild car entry e.g. CAR* would delete all tags starting with CAR)
2. Click the **Delete** button

To edit a Tag:

1. Click  next to the tag you wish to edit
2. Make changes to **Tag**, **Operator** and **bearing type** as required
3. Click **Save**

4.9.3 Assign Tags

The **Assign Tags** form [Figure 4-23] can be used by the RailBAM® System administrator to assign groups of orphan tags to rolling stock operators.



The screenshot shows a software window titled "Assign tags". Inside, there's a section labeled "Matched Tag" which displays "CAR 006620". Below this, a status bar indicates "Total number of records:1". The main interface has two input fields: "Tag criteria" containing "CAR*" and "Assign to" containing "Operator-1". To the right of these fields are "Search" and "Assign" buttons. At the bottom of the window are two more buttons: "Show Misread" and "Assign Misread".

Figure 4-23: 'Assign Orphans' form

To assign orphan tags perform the following steps:

1. Type in **Tag criteria** a tag or part of a tag then click the **Search** button, the form will display a list of all orphan tags that match the **Tag criteria**.
2. Select from the **Assign to** drop down menu the operator you wish to assign the listed tags to and click the **Assign** button.

You can also assign misread tags to a particular operator:

1. Click the **Show Misread** button
2. Select from the **Assign to** drop down menu the operator you wish to assign the listed tags to and click the **Assign Misread** button

4.9.4 Removed Bearings

The **Removed Bearings** form [Figure 4-24] is used for managing and telling the RailBAM® System which bearings have been removed from service.

IMPORTANT NOTE:

Bearings removed by the maintainer should be entered into this part of the database. It is important that this is done diligently to maximise the effectiveness of the RailBAM® System(s). The import facility described below will aid with this.

Removal date	Tag	Axle	Side	Wheelset	Removal status	Due to P.M.	Fault severity	Cone Rank	Cup Rank	Roller Rank	LF Rank
1/07/2010	C 10850	1	L		Completed	<input type="checkbox"/>	RS3				
1/07/2010	C 10850	1	R		Completed	<input type="checkbox"/>	RS2				
1/07/2010	C 10850	2	L		Completed	<input type="checkbox"/>	LF3				
1/07/2010	C 10850	2	R		Completed	<input type="checkbox"/>	RS3				
1/07/2010	C 10850	3	L		Completed	<input type="checkbox"/>	LF3				
1/07/2010	C 10850	3	R		Completed	<input type="checkbox"/>	FBS(LF3)				
1/07/2010	C 10850	4	L		Completed	<input type="checkbox"/>	RS3				
1/07/2010	C 10850	4	R		Completed	<input type="checkbox"/>	FBS(RS2)				
1/07/2010	C 10850	5	L		Completed	<input type="checkbox"/>	LF3				
1/07/2010	C 10850	5	R		Completed	<input type="checkbox"/>	FBS(RS2)				
1/07/2010	C 10850	6	L		Completed	<input type="checkbox"/>	LF3				
1/07/2010	C 10850	6	R		Completed	<input type="checkbox"/>	FBS(RS1)				
1/07/2010	C 10850	7	L		Completed	<input type="checkbox"/>	RS3				
					Pending	<input type="checkbox"/>					

Period: 01/Jul/2010 - 31/Jul/2010 | Including Orphans/Untagged | Including Removed Bearings
 Sites: Site1,Site2 | Operators: Op1,Op2
 Showing records 1-100 | Page 1
 Total number of records 2910

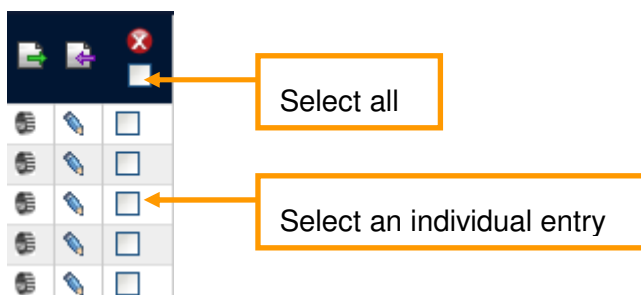
Figure 4-24: 'Removed Bearings' form.

The following information is displayed on the **Removed Bearings** form:

- **Removal date** is the date the bearing was removed from service.
- **Tag** is the tag ID of the wagon that contained the bearing [Refer to Appendix B.1].
- **Axle** is the wagon axle number from which the bearing was removed.
- **Side** is the side of the wagon from which the bearing was removed (R or L).
- **Wheelset** is the unique number assigned to each wheel-set.
- **Removal status** states the current status of the bearing (Pending or Completed).
- **Due to PM** is used to indicate if bearings were removed due to Periodic Maintenance.
- **Fault Severity, Cone, Cup, Roller & L/F rank** are used to store information concerning the fault type and fault levels


The **Removed Bearings** form possesses the following functions:

The delete button is used to remove selected entries





- The data entry bar is used to add new removed bearings

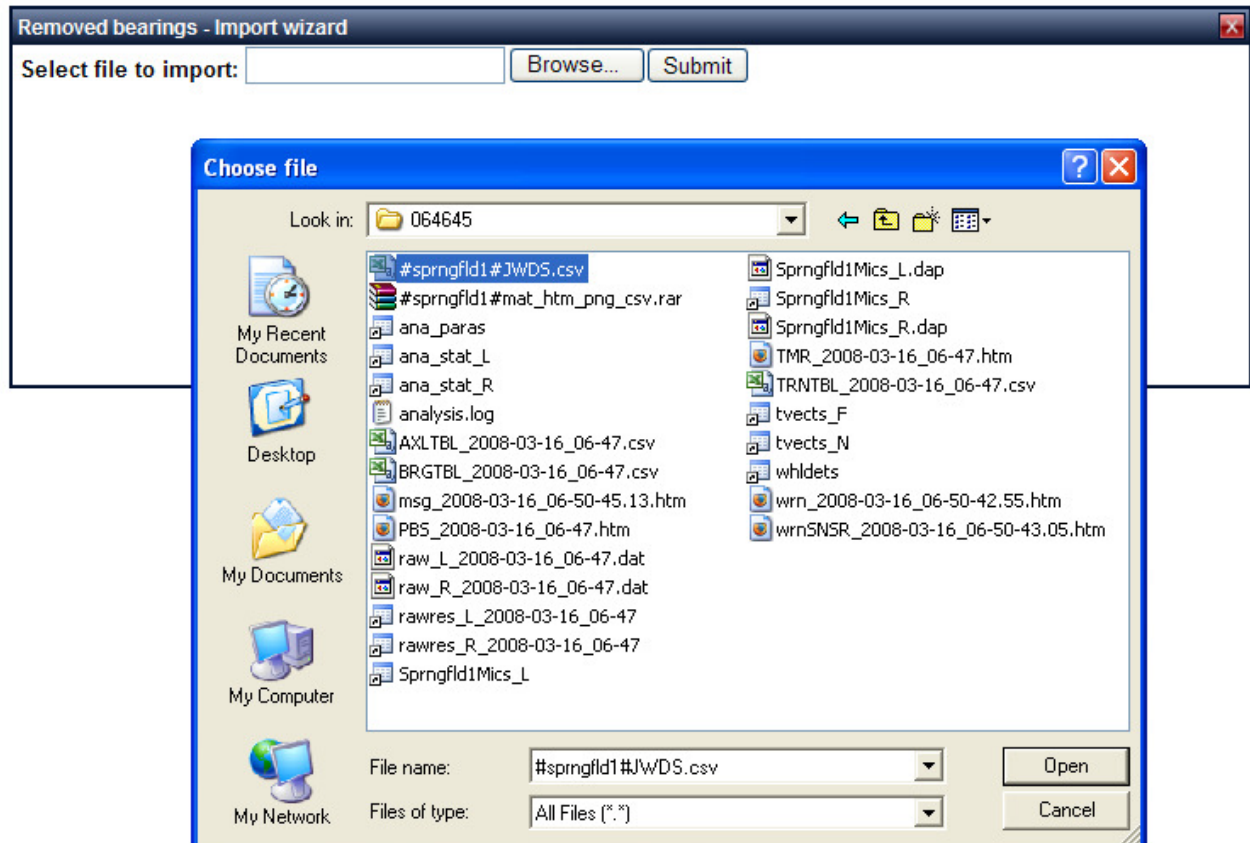
Fill in each column and click **Add**.

- The same data entry bar is used to edit a removed bearings entry:
 - Click  on the line you wish to edit
 - Make your changes
 - Click **Save**

Note: Once a bearing has been saved with **Removal Status** completed, all history for that bearing is flagged so that only the new bearing passes are shown. To view passes prior to the removed bearing date, the **Include Bearings Removed from Service** box must be ticked on the **Parameters** form.

- To export data to Microsoft Excel, click 
- To import data from a CSV or TXT file, click  to open the Removed Bearings Import Wizard form

When you click the import button you will be prompted with a Windows® dialogue box to select a file to import:






Navigate to the file of your choice and click **Open**. The Wizard automatically detects the column headers (fields) within the CSV or TXT file:

CSV Field name	RailBAM equivalent	T-SQL transformation
Trn_Axle	<input type="text"/>	<input type="text"/>
Trn_Pos	<input type="text"/>	<input type="text"/>
Track_Side	<input type="text"/>	<input type="text"/>
Severity	<input type="text"/>	<input type="text"/>
Toolbox_Ver	<input type="text"/>	<input type="text"/>
wavfile	<input type="text"/>	<input type="text"/>

Import with removal status as: Date format:

Select existing import profile: Save profile as:

- For each Field, select a RailBAM® equivalent description from the dropdown list.
- Optionally, you can declare an SQL statement to additionally process each field to conform to the RailBAM® data format
- You can also specify a default removal status and a Date Format to match the date format in your input file.
- When you have done the above, you should save your settings as a profile so they can be re-used at a later time by Entering a profile name and clicking 
- You can delete profiles by using the  button

Click  in the “Removed bearings – Import Wizard” form to import the data into the **Removed Bearings** form.

- Click  to open the Bearing Details and Inspection Results section:

These forms allow you to enter inspection results details.

Note: The data automatically saves as you type into each field.

Bearing details	Inspection Results
Tag: <input type="text" value="CAR 000597"/>	Axle: <input type="text" value="1"/> Side: <input type="text" value="R"/>
Type: <input type="text"/>	Date last reconditioned: <input type="text"/>
Serial number: <input type="text"/>	Last reconditioner: <input type="text"/>
Manufacturer: <input type="text"/>	Total months in service: <input type="text"/>
Was New: <input type="checkbox"/>	Total kilometres run: <input type="text"/>

- Type** contains a drop down list to select the type of bearing removed.
- Serial number** contains the bearing manufacturer’s serial number entered.
- Manufacturer** contains a drop down list of manufacturers to select the manufacturer of the removed bearing.
- Was New** is ticked if the faulty bearing was a new bearing. That is, it was never reconditioned.
- Date last reconditioned** is the date the bearing was last serviced/reconditioned.

- **Last Reconditioner** is the company who reconditioned the bearing.
- **Total months in service** is the total number of months the bearing was in use before removal.
- **Total kilometres run** is the total distance [km] run by the bearing before removal.

Bearing details		Inspection Results	
Tag:	CAR 000597	Axle:	1
Side:	R		
Seal defect	SWR edge wear	SWR bore wear	Cone defect
Cone defect size	Cone back face wear	Cup defect	Cup defect size
Roller defect			
Outboard:			
Inboard:			
Backing ring defect	Fitted	Bench end play	Assesment
Comments:			

- **Outboard** contains specific details about faults found on each component of the outboard bearing assembly.
- **Inboard** contains specific details about faults found on each component of the inboard bearing assembly.
- Information relating to the entire bearing assembly is found in **Backing ring defect**, **Fitted** and **Bench end play**.
- **Assessment** contains the bearing inspector's conclusion on the inspection.
- **Comments** contain additional information such as faults found, or a reference to an inspection report.

5. AUTOMATIC IMPORTER

When the **RailBAM®** Server detects new train data on a connected remote RailBAM® Wayside computer, the measurements are automatically downloaded from the wayside computer using the application 'AutoFTP'.

An alternative configuration is also allowed, in which the RailBAM Wayside computer uploads the measurements using 'AutFTPput' and 'FTPFetchAndProcess' applications. If the download/upload has been successful, the data is then automatically imported into the RailBAM® Trending Database.

Note:

- If an automatic download/upload is unsuccessful, an email is sent to the RailBAM® System administrator. In this case, the automatic import process cannot occur – the new train data will not appear in the database.
- In addition, the import process could fail if there is a problem with the measurement content, or file corruption. Again in this case the system administrator will be notified. The system administrator should attempt to re-report the train and download data manually to the database server.
 - Refer to the RailBAM® System user manual [RD/1] for details.
- The import process will automatically import the re-processed data during the next run.

6. AUTOMATED MESSAGES

The Importer/DataChecker can be configured to automatically send email alerts. If this is enabled, the DataChecker scans the history of each newly imported bearing and checks these against rules.

6.1 Fault Alerts

If this option is activated, rules that scan for trends that may indicate bearing deterioration are applied and fault alert emails are sent to the appropriate operator for individual bearings showing dangerous trends. Refer to RailBAM® Importer Configuration [RD/2] for details. An example is shown in Figure 6-1.

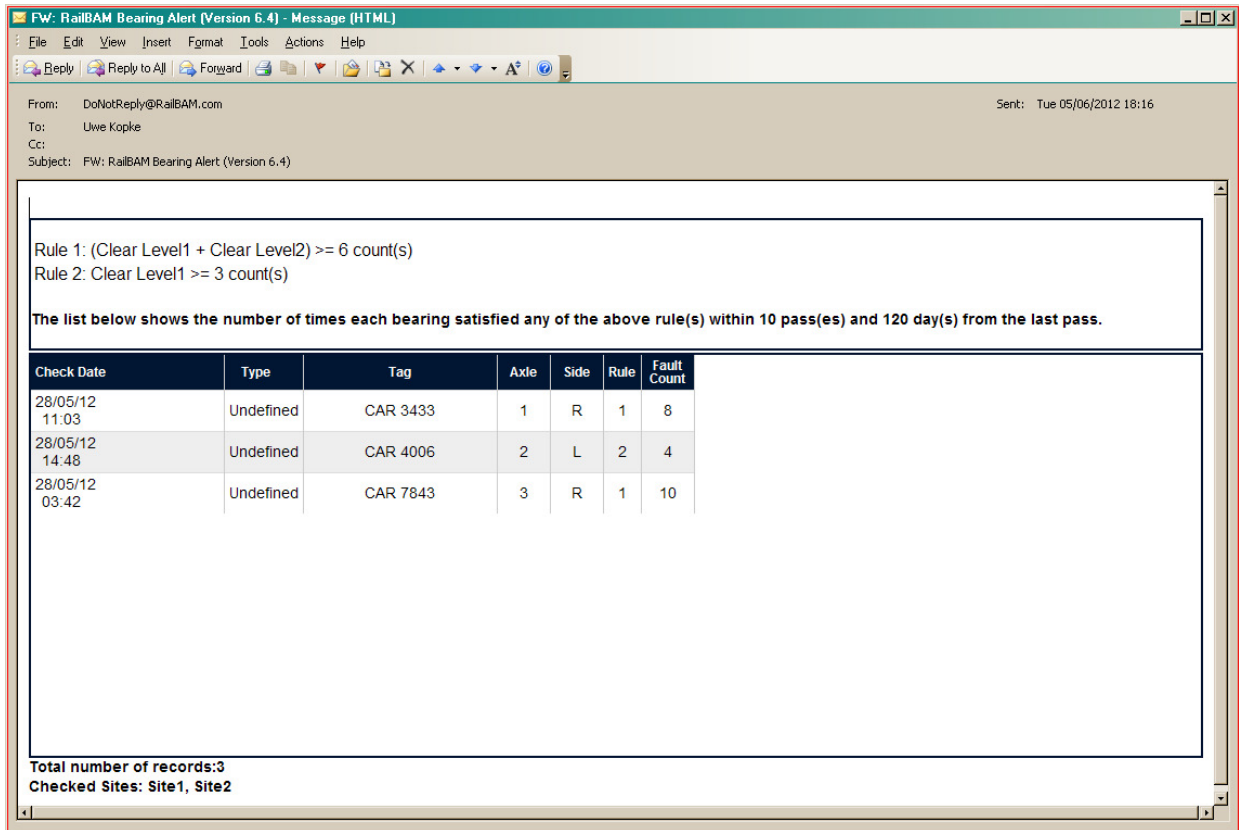


Figure 6-1: Trend Alert Email.

6.2 Fault Alerts for Replaced Bearings

If this function is activated, fault alert emails for bearings that become faulty soon after being removed and replaced (see also [Section 4.8.5]) will be sent to the appropriate operator.

Refer to RailBAM® Importer Configuration [RD/2] for details. An example is shown in Figure 6-2.

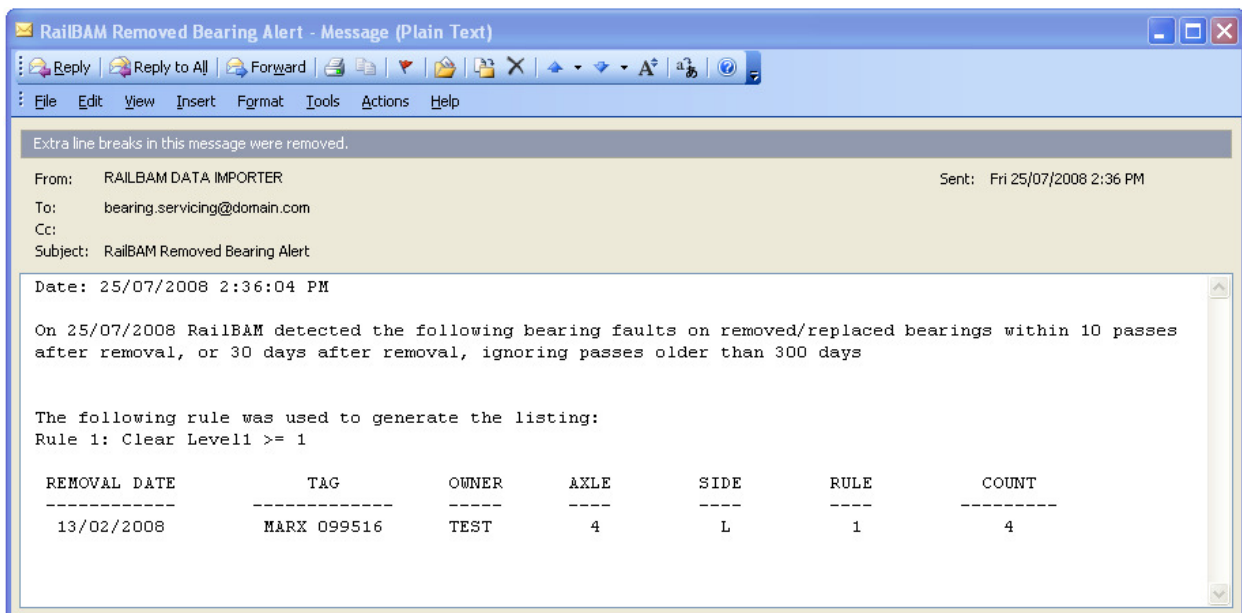


Figure 6-2: Trend Alert Email for Replaced Bearings.

7. INTERPRETATION OF TRENDING DATA

Tagging of wagons is essential to enable the consistent identification of rolling stock, and hence the compilation of bearing fault trends over time.

Each time a particular wagon passes any RailBAM® system, the spectra of faulty bearings / wheels only are retained and can be overlaid as in Figure 7-1 from the **Bearing History** form [Section 4.8.1]. Each pass-by of the bearing is plotted in a different colour to represent the date the spectrum was captured. The following examples show how the trended data can be used to interpret the deterioration of a bearing over time.

7.1 Peak Magnitude

Figure 7-1 shows the spectral plot of a cup fault with changing peak magnitude over time.

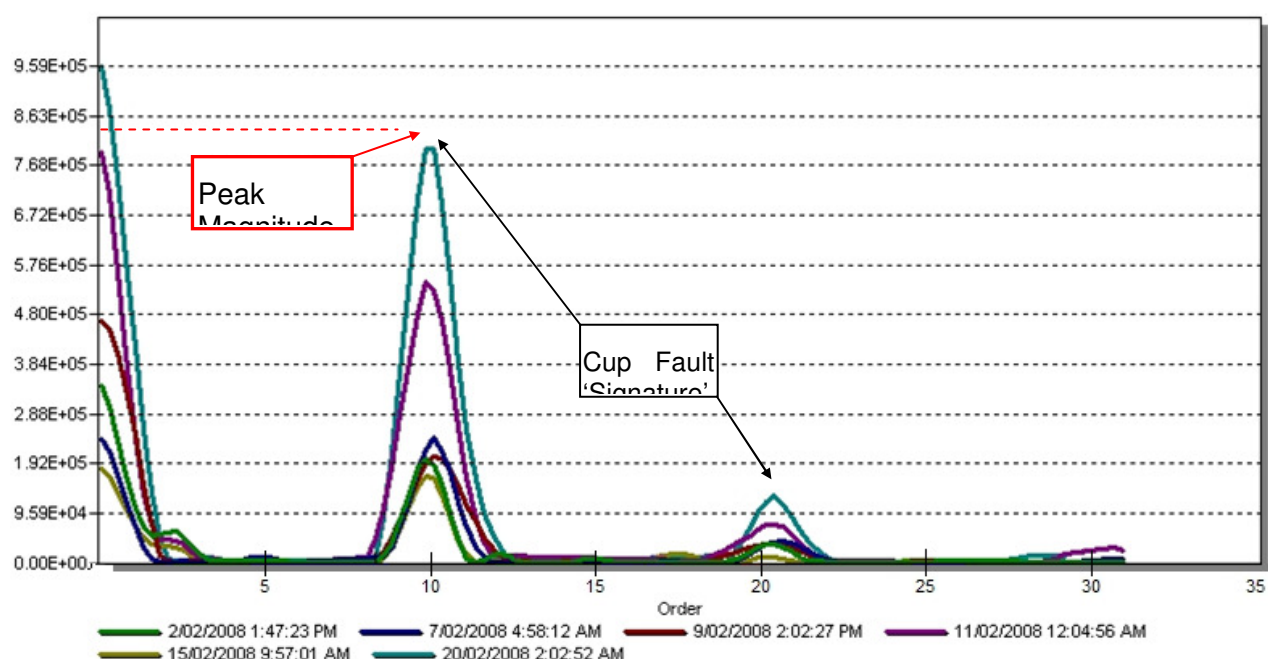


Figure 7-1: Significant cup fault at different pass-by times.

The peak magnitude is shown in Figure 7-1, where the red dashed line determines the magnitude of a peak from the vertical axis. The peak magnitude can be affected by any of the following factors:

- Bearing deterioration
- Wheel speed [Section 7.2]
- Direction of wheel rotation [Section 7.5]
- Axle load to a minor extent [Section 7.6]

An example in which the peak magnitude is used to interpret data is included in Section 7.4.

7.2 Fault Strength

The normalised fault strength is a more succinct measure for monitoring the development of a fault, since it is normalised for speed. In other words, the fault strength is only affected by the following factors (note that wheel speed is no longer applicable):

- Bearing deterioration
- Direction of wheel rotation [Section 7.5]
- Axle load to a minor extent [Section 7.6]

As explained in Section 4.8.1, the RailBAM® Trending Database contains graphs showing the fault strength for various kinds of bearing and wheel faults. To determine whether a RS fault is increasing or decreasing over time, the **dB Trends 1** graphs should be the primary consideration. These graphs show fault strength over time, so deterioration can be seen easily. Similarly the **dB Trends 2** graphs should be used for LF and WHLFLT faults.

Examples in which the fault strength is used to interpret trending data are included in Section 7.3 and Section 7.4.

7.3 Example: Increasing Fault Strength

Figure 7-2 shows the **dB Trends 2** plot for a significant Looseness/Fretting (LF) fault. The fault strength has grown consistently since the first reading.

Current evidence suggests that consistent increases in the fault strength can indicate deterioration of the bearing for any fault type.

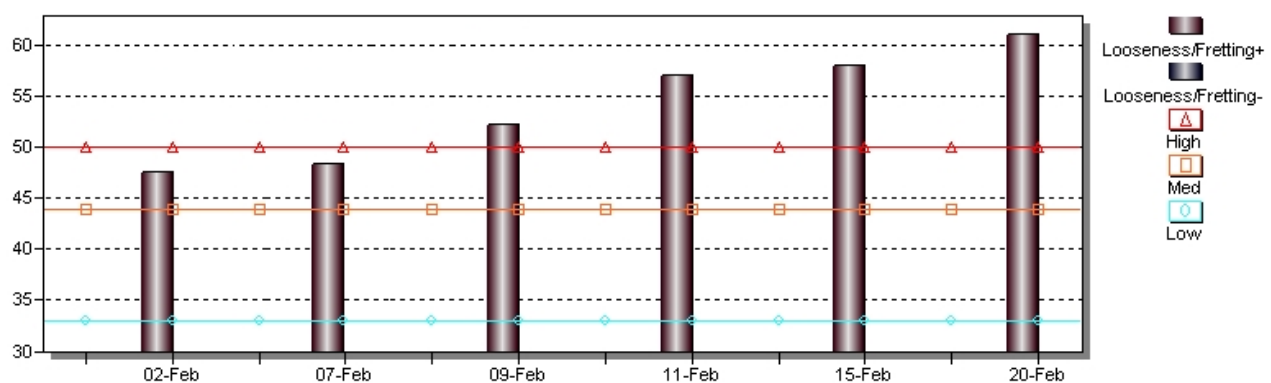


Figure 7-2: Increasing fault strength for a bearing with an LF fault.

7.4 Example: Sudden Decrease in Fault Strength

An example of the worst type of bearing deterioration is shown in Figure 7-3.

The peak magnitude reduces over time after a very high reading on 2/02/2008.

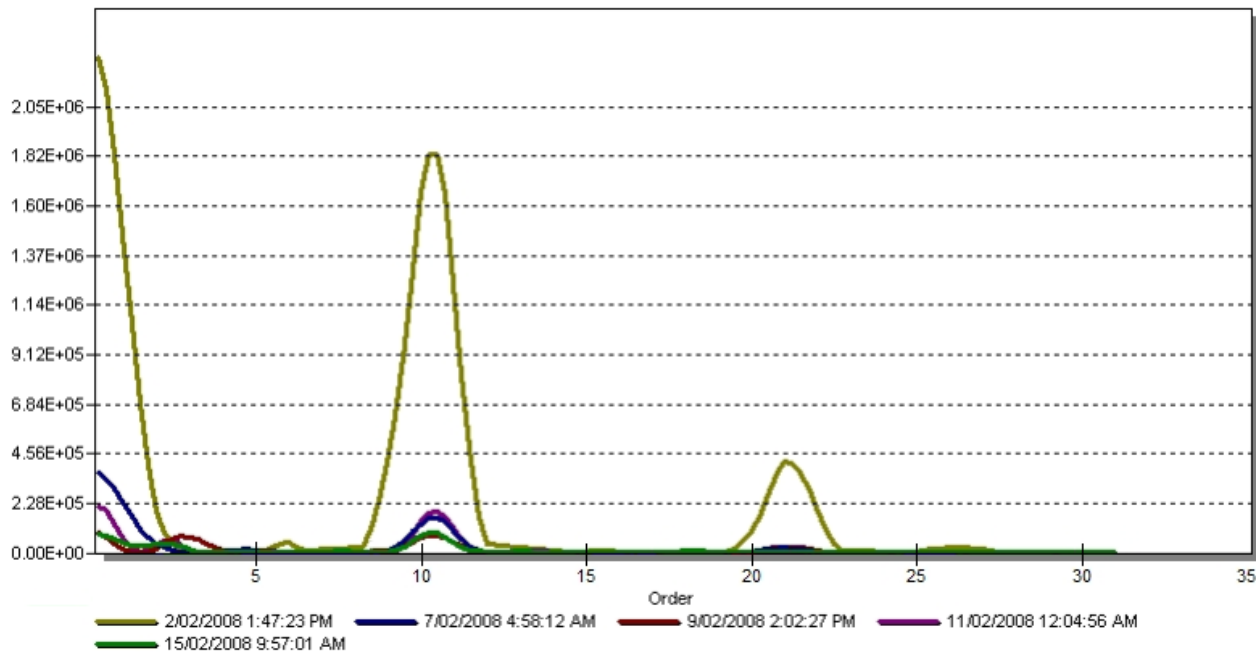


Figure 7-3: Peak magnitude reducing after a very high reading.

This could be due to reduced wheel speed, so RPM should also be considered.

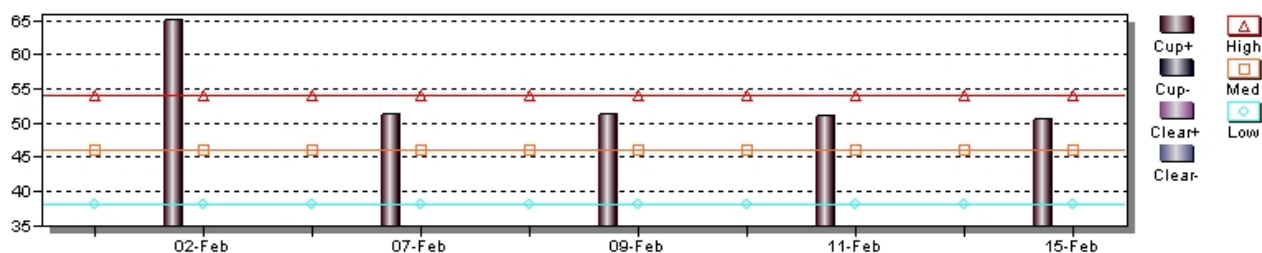


Figure 7-4: Fault strength reducing after a very high reading.

The fault strength also shows a very high reading followed by lower readings, indicating this is potentially a well-developed fault.

As a fault becomes well developed, a lot of metal is removed from running surfaces. The rollers pass over deteriorated areas that are sufficiently large to avoid an impact. That is, the rollers become either airborne or the entry/exit of the fault has 'rolled out' to form a gentle slope. Both effects make the fault 'silent' and therefore undetectable by acoustic means. Often the mistake is made to assume that the bearing has 'healed' since there is no longer a peak in the spectrum. However the bearing now has debris within the grease making failure more likely.

7.5 Direction Dependent Faults

Some faults are direction dependent, meaning the fault is more prominent when the wheel is rotating in one direction rather than the other. The example in Figure 7-5 clearly shows an LF fault that is consistently direction dependent since higher fault strengths are always seen with the wheel rotating in the **negative** direction.

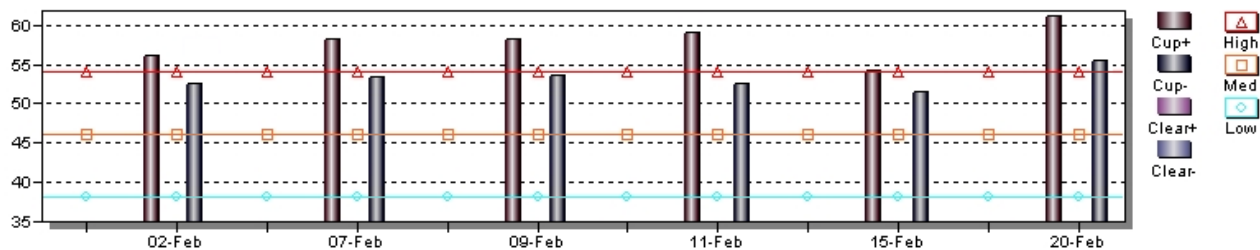


Figure 7-5: Direction Dependent fault, more prominent in negative direction.

If a fault is direction dependent, and a high fault strength was recorded with the wheel rotating in one direction, followed by low fault strength readings when the wheel was rotating in the other direction, this is potentially a cause for the example in Section 7.4. Cases such as this should be closely monitored to determine whether the fault is consistently direction dependent. If the fault in this example is not consistently direction dependent, it is likely the bearing fault has become very developed.

7.6 Axle Load

Research has shown that the fault strength of RS faults is not significantly influenced by axle load. The tare weight of a wagon is sufficient to create a fault signature that is easily detectable.

Changes in fault strength for some types of LF faults may be caused by axle load. If a wagon is seen with a particularly large or small load, this may cause one high or low reading of fault strength, however it is consistent trends over time that best show bearing deterioration.

SUPPORT

For further information on the use of the RailBAM® Trending Database, please ask your demonstrator or contact Track IQ™: railbam@vipac.com.au.

Track IQ™ is committed to the continuing development of products and training. Suggestions are appreciated and can be emailed to railbam@vipac.com.au.

Appendix A: Important Terms

TERM	DEFINITION
Administrator – RailBAM® System	A person with permission to change settings of a RailBAM® System.
Bearing ID	The axle number and side for a particular bearing. See Appendix B.1.
Clpd	Clipping caused by saturation of the microphone signal. See Section 3.4.
dB Trends 1 plots	These plots display fault strengths (normalised to speed) for running surface faults. See Section 4.8.1.
dB Trends 2 plots	These plots display fault strengths (normalised to speed) for all faults except running surface faults. See Section 4.8.1.
Descriptor	Component of severity classification used to reveal detail about the fault. For example _p, _n, _r, _m, _e, _s. See Chapter 3.
Direction Dependent	A bearing / wheel fault which is more prominent when the wheel is rotating in a particular direction. See Section 7.5.
Fault Strength	A measure of the strength of a fault that is normalised for wheel speed. See Section 7.2.
FBS	Extraneous noise from Flanging, Braking or Slamming that may interfere with bearing and wheel fault analysis. See Section 3.4.
History Plots	This displays a spectral plot and a RPM graph. See Section 4.8.1.
Level	Component of severity classification used to identify the severity of the fault. For example 1 (Severe), 2 (Moderate) or 3 (Minor). See Chapter 3.
LF	Looseness / Fretting type of bearing fault. See Section 3.2.
NOISY	Unknown extraneous noise that may interfere with bearing and wheel fault analysis. See Section 3.4.
Order	The unit used on the horizontal axis of RailBAM® spectral plots. One order = one revolution of a wheel.
Orphan	Rolling stock for which an operator has not been assigned. See Appendix B.2.
Peak Magnitude	The magnitude of a peak read from the vertical axis in a RailBAM® spectral plot. See Section 7.1.
Prefix	Component of severity classification used to identify noise that may interfere with bearing or wheel fault detection. For example, Clpd, Shrkr, FBS, NOISY. See Chapter 3.
Roller Pass Frequency	Rate at which the rollers pass over a point on the cup and cone raceways
RS	Running Surface type of bearing fault. See Section 3.1.

Severity Categories	A group of severity classifications. See Chapter 3.
Severity Classification	An identifier for the type and extent of fault development. See Chapter 3.
Shrk	Shrieking - a strong tonal sound that is removed before bearing and wheel fault analysis. See Section 3.4.
Spectral Plot (RailBAM® Spectral Plot)	A plot showing fault spectra or 'signatures' with peak magnitude on the vertical axis, and order on the horizontal axis.
Tag ID (Wagon ID)	The tag number unique to each wagon. See Appendix B.1.
Type	Component of severity classification used to identify the most likely type of fault as predicted by the RailBAM® System. For example, RS, LF, NOISY, WHLFLT. See Chapter 3.
WHLFLT	Wheel defect type of fault. See Section 3.3

Appendix B: Bearing Location Convention

B.1 Tagged Rolling Stock

Where rolling stock is tagged, the location of a specific bearing on a wagon (**bearing ID**) is notated according to the convention selected by the RailBAM® System administrator. The **bearing ID** does not change with direction.

The **tag ID** refers to the number and letters uniquely assigned to each tagged wagon. A tag ID may consist of different combinations of letters and numerals.

Specific bearing locations cannot be determined for untagged rolling stock.

B.2 Orphans and Untagged Rolling Stock

Rolling stock for which an operator has not been assigned in the RailBAM® Trending Database are referred to as orphans. Information about which orphans exist is available to all users, including history and trending data.

When the operator of an orphan is identified, this information must be added to the **Permitted Users Tags** table by the RailBAM® System administrator as described in Section 4.9.

B.3 Viewing Orphans and Untagged Rolling Stock

To view untagged and orphan rolling stock, click **Orphans Tags** from the **Tags & Maint** section in the application menu.